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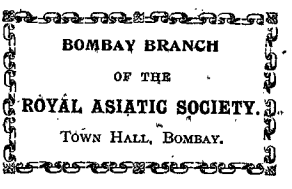

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Indian Plague Commission, 1898-99.

MINUTES OF EVIDENCE

TAKEN BY THE

INDIAN PLAGUE COMMISSION

WITH

APPENDICES.

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VOL. III.

EVIDENCE TAKEN FROM 11TH FEBRUARY 1899 TO 20TH MAY 1899.

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PROCEEDINGS

OF

THE INDIAN PLAGUE COMMISSION.

VOLUME III.

EVIDENCE FROM 11TH FEBRUARY 1899 TO 20TH MAY 1899.

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MINUTES OF EVIDENCE

TAKEN BEFORE THE

INDIAN PLAGUE COMMISSION.

NOTE.—Each witness, as far as was possible, put in a précis of the evidence he was prepared to give. The précis, when available, was printed, and copies of it were distributed to the Members of the Commission prior to each witness' examination. The précis does not form a part of this record of the Commission's Proceedings, but is referred to in the questions put to witnesses in examination.

At The Secretariat, Bombay.

Saturday, 11th February 1899.

FORTY-FIFTH DAY.

PRESENT:

PROF T. R. FRASER, M.D., L.L.D., F.R.S. (*President*).

Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. R. B. STEWART, I.C.S., called and examined.

Mr. R. B. Stewart, I.C.S.

11 Feb. 1899.

16,878. (*The President.*) You are Secretary to the Government of Bombay?—I am Acting Secretary.

16,879. You have had experience of plague both in the Nasik district and in Bombay?—Yes.

16,880. In what part of the Nasik district was your first experience?—In Igatpuri.

16,881. At what time did the plague occur there?—We found it first on the 3rd of August 1897. I went down there on that day with Dr. Anderson, who was the Deputy Sanitary Commissioner. We had heard that there were cases there, and we went down to enquire into them. I was Acting Collector and District Magistrate at the time. We found that there were cases, and we reckoned that they must have begun about a fortnight before that—about the middle of July.

16,882. How did you get information?—We heard on the railway line; we were out inspecting a famine camp, and we heard from the railway people that there were cases at Igatpuri.

16,883. Was there no arrangement for obtaining early information of plague cases in this place?—There was a railway surgeon there, but he was not very energetic over it. I think he was rather afraid of going into the houses and examining the patients. The Mamlatdar would have reported the cases had he known of them, but there was no medical man, other than the railway surgeon, to tell him that cases were actually occurring.

16,884. Did you ascertain where the plague had come from?—As far as we could make out it came either from Bombay or Poona. There was plague at both those places at the time. One lot of people had come from Bombay and one lot had come from Poona. We could not make out definitely which had established the plague in Igatpuri; there were cases of plague in both families.

16,885. What action did you take?—A lot of the people had run away.

16,886. Why?—They ran away directly cases occurred.

16,887. They were frightened of the plague?—Yes, they were frightened on account of the plague. Of course at that time of the year it was quite impossible to put anybody out into camp or huts. The rainfall averaged about 1 inch a day. It was just at the edge of the Ghauts, and the total rainfall during the five months of the monsoon is between 100 and 120 inches, so that we could not do anything in the way of putting people outside. We closed the Municipal school, and took the building for a hospital, and then all we could do was to put the people attacked into hospital, to clear up and disinfect houses which had been vacated by their owners, and put the people from infected houses into them.

16,888. By cleaning up do you mean something different from disinfection?—We had them emptied and washed out and brushed out, and flushed down with perchloride.

16,889. What effect did these measures have on the epidemic; was it checked, or not checked?—I should say it was not checked; it ran its course. The town is really only a long strip alongside the Bombay-Agra road, and there are about two rows of native houses.

16,890. The chief measure you adopted was disinfection?—Yes, and the removal of patients to hospital.

16,891. Notwithstanding that, plague extended?—Yes, it went right through.

16,892. How long did it last?—It lasted for just about 13 weeks.

16,893. Do you know the total number of cases?—No, I could not tell you that.

16,894. What is the total population of Igatpuri?—About 6,000.

16,895. What was the total number of patients?—I cannot give the number of patients in hospital. There were 518 cases of plague and 421 deaths.

Mr. R. B. Stewart, I.C.S.

11 Feb. 1899.

16,896. People ran away. Did they carry the plague elsewhere?—Yes. As far as we could tell, they took it first into Ghoti, which is about four miles off, and is a considerable market town in that part; it is the largest market village about there. They took plague there first. We did not hear about it for some time, and then I heard rumours of cases there, so I sent the Mamlatdar to make inquiries. He went there with an Assistant Surgeon and others and they were assaulted, and several of them badly hurt.

16,897. Do you know why you did not get early information?—Simply from the neglect of the village officials.

16,898. You had an organisation in operation?—We had no organisation, except orders to the officials to keep plague-stricken people out, to be very careful who they let into the village, and to report at once any increase in the number of deaths.

16,899. How large is Ghoti?—The population is about 2,000.

16,900. You had nothing in the nature of house-to-house visitation?—Nothing whatever.

16,901. What action did you take in each case?—Immediately after the riot nearly all the people fled away.

16,902. Where to?—To different villages. Of course there was a police inquiry into the riot. We turned all the rest of the people out, the few who remained—about 200 or so—into huts. Ghoti is a little further away from the edge of the Ghauts than Igatpuri, and the riot took place at the end of September, when the rains were beginning to cease, so we turned them out and disinfected their houses. They got rid of the plague very shortly, but of course the people had nearly all left the village.

16,903. In what time did those that remained become free of plague—the segregated people?—They had a few cases for a week or two only, and then it stopped altogether.

16,904. Another village which was affected was Munmar?—Yes, that was a separate infection. That was not infected from Igatpuri. It is a good deal further up the line; it is a junction between the Dhond and Munmar State Railway and the G. I. P. main line.

16,905. Was your action similar in this case to the last one?—Yes, except that there we got most of the people out of their houses.

16,906. Where did they go to?—They went into their fields; we had better examination there. We had men down there, and they examined the people who remained in the village, and also the people in the fields.

16,907. Those that had removed from their original houses?—Yes, from their houses into their fields; it was dry then.

16,908. Were the houses disinfected?—Yes.

16,909. How long did they remain out of the village?—I could not say definitely how long they remained out. They were not all back when I left Nasik. I left Nasik in February 1898.

16,910. In what month did they go out?—In September and October.

16,911. Had plague ceased when you left?—It had not absolutely ceased.

16,912. That measure, also, was not very effective?—There were very few cases. Of course it is very difficult to control them unless you can keep them all in a camp.

16,913. Were not these people in a camp?—They were not in a camp; they were in the fields.

16,914. When out of control, how do you think the plague continued to extend?—That is very difficult to say. Of course they got back to their houses at night.

16,915. Were not the doors sealed?—No.

16,916. Did they go back, to your knowledge, and sleep in those houses?—They did not go back with our permission.

16,917. Did they sleep in their houses?—Some of them did, undoubtedly.

16,918. You had plague in Nasik itself?—Yes.

16,919. That is a larger town?—It is a town of about 25,000 people.

16,920. Do you know when plague first occurred in Nasik?—The first indigenous cases occurred on the 12th of October 1897.

16,921. Do you know how it was introduced into Nasik?—I believe it was from Ghoti.

16,922. On what grounds do you base that belief?—I did not personally investigate the first one or two cases, so I could not be certain.

16,923. Were you told so, or did you fancy it was so?—I was told by the Civil Surgeon, but I would not be certain whether it was from Bombay or by people coming from Ghoti.

16,924. Did you take measures immediately after the knowledge of the outbreak in Nasik?—We started disinfecting the houses at once.

16,925. What houses?—The houses in which cases occurred.

16,926. How did you effect the disinfection if the people were still in their houses?—The people were taken out.

16,927. The first thing you did was to remove them?—Yes.

16,928. Then you disinfected the houses?—Yes.

16,929. Did you remove any people who lived in the neighbourhood of the infected houses?—Not at the very beginning.

16,930. How long did you wait before you did this?—About a fortnight or three weeks after the first cases. Then we began more wholesale removals.

16,931. In this fortnight in which you were not removing people from neighbouring houses, what was the course of the epidemic: was it checked by the measures then adopted or not?—No.

16,932. Then you adopted more stringent measures?—Then we began moving people out of houses on each side.

16,933. How many houses on each side?—At first we took two on each side; then we found that that was not enough, so we took three on each side, and six opposite. Still it went on, so then we evacuated whole quarters. The town was divided up into wards, and we evacuated gradually the wards as they got infected.

16,934. The wards were completely evacuated?—Yes.

16,935. And a large part of the city was therefore finally evacuated?—The greater part, nearly the whole.

16,936. One side of the river?—One side of the river, yes.

16,937. What was the result of the larger measure—of these final steps?—The plague went on of course. It resulted in, I think, a comparatively small number of cases. There were only about 450 cases in the whole town.

16,938. Before you adopted the final measures how many cases were there?—There were 40 cases up to the second week in November. Then evacuation by wards was commenced.

16,939. After you adopted the final steps how many cases did you have?—It was still going on. We did not evacuate the whole town at any one time.

16,940. The greatest step you took, I understand, was to evacuate all on one side of the river?—It was not all done at once.

16,941. Was the final result that the whole town was evacuated?—All on that side of the river.

16,942. When was that result accomplished?—In the first week in January the last of the blocks on the south of the Godaveri River was evacuated.

16,943. How many cases occurred after the final evacuation?—57 in January and 18 in February. I left Nasik on February 15th.

16,944. Were you fairly well satisfied with the effect of the final action you took?—Yes, I think we would have done better had we evacuated the town more rapidly.

16,945. Could you state generally how it affected the epidemic?—Of course I had not seen other places, but, compared with the figures given for other places, I think the number of cases we had was comparatively small.

16,946. When did the disease finally cease in Nasik?—I was not there. There were a few cases after I left

in February. The last cases I have got down here are for the week ending the 25th of March 1898. There have been no cases since then until about three weeks ago.

16,947. You cannot speak of these?—No.

16,948. I think you assumed work in Bombay in the middle of February 1898?—Yes.

16,949. Which ward had you charge of?—Edward Byculla and Mazagon.

16,950. Is that a large ward?—Yes.

16,951. What is the normal population?—Between 180,000 and 185,000.

16,952. What steps did you adopt here?—Chiefly disinfection. We removed patients to the hospital, and contacts; but of course the contacts are a very different matter in Bombay to what they are up country.

16,953. Where did you remove the contacts to?—To camps; we had different camps; I had one large camp in Byculla, and there was a camp attached to the Mahratta Hospital, to which a number of people went.

16,954. This measure was interrupted, was it not?—Yes. It was interrupted on the 9th of March 1898.

16,955. How was that?—It was interrupted by a riot.

16,956. Subsequently to the riot what has been the procedure?—We continued much the same procedure, except that the wholesale evacuation of large chawls was lessened. Of course that could not go on after the rains began, because almost all vacant spaces for camps are on low-lying ground, where the water lies.

16,957. I think we already have the figures showing the extent of the epidemic at this time?—Yes.

16,958. That constitutes your personal experience?—Yes.

16,959. Have you any knowledge of the influence of rats in the propagation of the plague?—No, I have not.

16,960. You have had considerable opportunity of observing the plague in different places. Can you associate its extension anywhere with rats?—No, I have never been able to trace the spread of infection to rats.

16,961. Have you any opinion on that subject based on what you have observed?—No, I have had no experience of rats at all.

16,962. Have you seen plague extend itself where there appeared to be no conveyance by means of rats?—We had no signs of conveyance by means of rats in Nasik at all.

16,963. You had no appearance of dead rats?—We found dead rats occasionally.

16,964. Not in large numbers?—No, and we had no means of having them examined.

16,965. They were not examined bacteriologically?—No; but they were certainly not found anywhere there in large numbers.

16,966. How, then, do you think that plague is extended or carried from one house to another, or from one district to another?—As far as I can see it is brought in by people who are infected. People come from infected places and live in clean houses, and apparently after some while they infect the houses. We had imported cases from time to time in Nasik. The first case I saw was in March 1897. That was an imported case. The house was disinfected and nothing more happened. And then there were similar cases from time to time up till October, when we got indigenous cases.

16,967. In your experience, if you get early information of an imported case, and deal with that case as you have described, plague may not become indigenous in a town or village?—I think so if you get early information.

16,968. Early information seems to be a matter of great importance?—It is.

16,969. As to other methods to adopt in dealing with an epidemic, upon what do you place the greatest trust?—Evacuation and cleaning.

16,970. Cleaning, including disinfection?—Yes, including disinfection, but also including cleaning the surroundings.

16,971. Do you generally find the surroundings very unhealthy?—Yes, particularly in Bombay.

16,972. In Nasik?—In Nasik they are not so bad. Of course you do not get so much water lying about here; it is not so damp.

Mr. R. B. Stewart, I.C.S.

11 Feb. 1899.

16,973. What kind of houses are they in Nasik—in the plague district?—In Nasik itself there are all kinds of houses; there are very poor houses. Plague began in the south.

16,974. Are they small houses?—Yes, many of them.

16,975. One floor?—They are chiefly one floor.

16,976. Of how many chambers does a house consist?—Two or three, sometimes; often there is only one room.

16,977. Generally speaking did you find that the worse the houses in a district, the more prevalent plague was?—No, I could not say that.

16,978. Still, all the houses in which it chiefly occurred were of a bad character?—They were bad in some way or another. Some of the houses were exceedingly well built—the big houses, but they are dark, badly lighted, and badly ventilated.

16,979. Is there much overcrowding in Nasik in the poor houses?—No, I do not think there is much overcrowding.

16,980. Supposing you take one of these houses, consisting of one chamber, how many people would reside in such a house?—Probably only the father and mother and two or three children.

16,981. How large is this chamber?—About 10 to 12 feet square.

16,982. This is undoubtedly overcrowded, is it not?—Of course that is overcrowded, but there is nothing like, for instance, the chawls in Bombay.

16,983. What means of ventilation would a one-chamber house have?—Practically nothing but the doorway; there is a window, but it is generally blocked up.

16,984. What was the kind of floor?—Mud.

16,985. In Bombay you think the sanitary condition is worse than in Nasik?—It is worse; because there are more people, and the overcrowding is very great.

16,986. I think you said also that they are dirtier?—Yes, they are dirtier. I am talking particularly of the chawls; the occupants have less interest in them, as they are not their own houses.

16,987. In the last paragraph of your précis of evidence you have expressed your opinion as to the methods of dealing with the disease?—Yes, it is as follows:—"As regards methods of dealing with the disease, I can speak only of evacuation and disinfection, as I have practically no experience of inoculation. In the efficacy of evacuation and disinfection I fully believe, and I would resort to wholesale evacuation wherever possible. In the mufassil such measures are naturally less difficult of accomplishment than in Bombay, and in Nasik I had the great advantage of having been in the district for some years, so that the people knew me, but even in Bombay I believe that evacuation could be largely carried out. It is difficult, of course, to deal with a large shifting population, and especially when the officers in charge and the people are mutually unacquainted, but it is not impossible, and though inoculation may assist by giving confidence, I would rather trust to evacuation with disinfection. Thorough cleaning is one of the most difficult things to carry out, and especially when an epidemic is severe. The coolie does not understand, even after months of instruction, that the whole work of cleansing a room may be nullified by his leaving a corner untouched, and the best of them will not grasp the importance of cleaning every spot inside and out. The consequence is that an immense amount of personal supervision is required, supervision over the materials and their preparation, supervision of the men and examination of their completed work, but if a house or row of houses is once thoroughly cleaned, and can be kept reasonably clean, as far as I have seen, there is little danger of plague breaking out there again. House-to-house visitation and inspection are practicable in the mufassil when the families living in the different houses are known and the absence of any one member is at once noticed, but even then it is difficult to make it effectual without considerable annoyance to the people. In Bombay, with its immense chawls full of lodgers, who have little kit, and can shift at any moment, house-to-house visitation is of comparatively little use, and the only way to discover cases of plague seems to be to employ

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spies, and to keep as careful a watch as possible on the cemeteries. Many cases have been discovered in large searches with troops, but such searches cause great alarm, and I would not use troops until there is good reason to believe that an area is badly infected, and other means of discovering cases have failed."

16,988. Have you anything further to say with regard to this paragraph, or as to any other point that I have asked you about?—Not as regards the value of evacuation and disinfection.

16,989. You consider they are of great value and of paramount importance?—Yes.

16,990. (*Dr. Ruffer.*) Did you find that the people at Nasik began to leave before you were informed of the presence of plague?—Not at the beginning.

16,991. They only began to leave after you arrived?—After we began to take measures.

16,992. You mention in your précis of evidence "the "newly-organised flying columns." What did each of the flying columns consist of?—The one we had at Igatpuri had an Assistant Surgeon in charge, and he had two Hospital Assistants under him. Then they brought up, I think it was, two gangs of trained coolies from Bombay, who knew the disinfection work.

16,993. How many men were there in each gang?—As far as I remember there were ten in each gang. Then, of course, we supplied other coolies who learnt the work from them.

16,994. Who prepared the disinfecting solutions, the perchloride of mercury, and so on?—In Igatpuri the Assistant Surgeon did it. It was done there by powder in the first instance; the powder was poured into the tubs and stirred up.

16,995. Did you add any acid?—Yes.

16,996. How much?—I do not know. After that, in Nasik, it was prepared chiefly by Dr. Maynard.

16,997. In how many plague houses did you find dead rats?—I could not give you the numbers.

16,998. Would the number of houses be considerable?—No. We found no rats practically; I do not think we found a single rat more than you would find in the ordinary way in walking down any street.

16,999. You say in your précis: "The only way to "discover cases of plague seems to be to employ spies, "and to keep as careful a watch as possible on the "cemeteries." What do you mean by "as careful a "watch as possible?" Do you intend to say that the corpses should be inspected at the cemeteries?—No, I do not mean the corpses should be inspected, but you should see that no body is buried or disposed of at the cemetery until the fact of the death is known to the authorities in the town. I mean, keep a watch so that people do not take away corpses and dispose of them without you knowing where they come from.

17,000. I suppose the friends give the address of the corpse at the cemeteries?—Yes.

17,001. They can give you a wrong address?—They very often do, down here.

17,002. In what proportion of the cases do they give a wrong address?—It is difficult to give any accurate figures. I should say about five per cent., but that is a pure guess.

17,003. You said that the living rooms in Nasik were 10 to 12 feet square?—Yes.

17,004. Is that exactly what you mean?—That is the case in small huts. In the better class of houses the rooms are often large and well proportioned.

(Witness withdrew.)

Lieut.-Col. G. Waters, I.M.S.

Lieutenant-Colonel G. Waters, I.M.S., called and examined.

17,005. (*The President.*) You are in the Indian Medical Service?—Yes.

17,006. What are your medical qualifications?—Licentiate of the Royal College of Surgeons, Edinburgh, and Physicians.

17,007. You are the Presidency Surgeon for the third division of Bombay?—Yes.

17,008. What duties are implied in that office?—I have to attend all Government servants in that district and their families. I have to look after a large charity school—the Byculla School; and I have two jails, one called the House of Correction in Byculla, and the other the Common Jail in a neighbouring district called Umarkhadi. I am Joint Inspector of Factories for that division also. That is an attached duty.

17,009. How do your duties bring you into relationship with plague?—Plague has attacked each of the institutions with which I have to deal, that is to say, the School, the House of Correction, and the Common Jail in Umarkhadi; but the Common Jail, beyond one case, was not attacked at all during my presence there. I may say that on the 9th of October last year, I went on sick leave.

17,010. As regards the origin of plague outbreaks, have you any knowledge, or distinct opinion?—In Bombay, the plague began in a district called Mandvi, and the houses attacked, seemed to me to have a particular bearing with regard to the direction from the opposite side of the road. The inhabitants of the higher and the more prominent houses facing the Argyle road, and in the immediate vicinity of the Argyle road, were most attacked with the plague.

17,011. Does that cause you to form any opinion as to the origin of the outbreak?—My opinion as to the origin of the outbreak in Bombay was that inasmuch as the cases occurred first in that neighbourhood, the causative factor existed there. They occurred first in that neighbourhood, and in the immediate vicinity of those houses we have the granaries, the grain stores of Bombay. They are just across the road from the places which I have been speaking of.

17,012. You think, therefore, that the granaries have had something to do with the origin of plague?—My attention was directed to the granaries from the fact that the first cases I heard of occurred in one of them, in the one belonging to Messrs. Ralli Brothers. There were 13 persons attacked. This was, I think, about the first incident of the plague—about 13 employés were attacked in one granary and they all died.

17,013. This was the first occurrence of plague in Bombay?—I think this was one of the first known incidents of the plague.

17,014. Were there any cases prior to the cases in this granary?—I daresay there may have been.

17,015. Then the cases you speak of, may not have been the first?—No, that was the first incident of which I was aware, and the next thing I became aware of, was noticing that the people in the higher houses in the immediate neighbourhood had the most plague victims.

17,016. Do you mean chawls?—We call them chawls but they are large tenements. These large tenements had victims in the upper storeys of the higher houses, and not in the lower storeys. At first, the people attacked were all in that particular neighbourhood, and then in the streets leading from Argyle road inwards towards Mandvi, the prominent houses in these streets leading off Argyle street, the houses with exposure towards Mandvi, were the houses that had the victims.

17,017. Do I understand you to imply that plague first gained a hold in the grain depôts, and then extended from them to the higher floors of the chawls?—No, I gave no theory as to that.

17,018. What do you wish us to understand?—I mean that some emanation, some fungus from the grain, blew in that direction, and affected the people who were most exposed to it.

17,019. What reason have you for supposing that the stores of grain had anything to do with the origin, beyond what you have said?—I had the knowledge that in Garhwal, on the southern slopes of the Himalayas, they had frequently outbreaks of plague, and that was supposed to be connected with the storage of grain.

17,020. What is the connection with the storage of grain, in your opinion?—My idea is that by the protracted and faulty storage of grain, grain to which damp has got access becomes attacked with this fungus, and it becomes the scene of the operations of this fungus.

17,021. What fungus is this?—I mean the bacillus—the plague germ—and generated either there, or quickened into activity by that contact, it then spreads by the wind.

17,022. Have you any knowledge as to how this bacillus is introduced into the grain?—I have no knowledge as to that. That is only a supposition, a theory, that I have formed from my own observations.

17,023. And you think the dissemination to a given spot is air-borne?—I think it is mostly air-borne.

17,024. Do you find there is a greater diffusion in windy weather than there is in still weather?—It is difficult to say in Bombay which days are windy and which not. We always have a sea breeze here.

17,025. Have you any still days?—Absolutely no still days. I have made no observation as to that.

17,026. What are the facts on which you base the idea that the bacillus in its dissemination is chiefly wind-borne?—The prevailing breeze from that point is in the direction in which most people were attacked. The breeze is not always constant from one point, but that is the prevailing breeze. There was another grain store in Kolaba, and Kolaba and Mandvi were the two points where plague started in Bombay. From those two points plague spread inwards and southwards. It it spread mostly in the direction the wind blows—from Mandvi right up by Umarkhadi and Byculla, and the two jails are in the direct line of fire from Mandvi, judging by the prevailing breeze.

17,027. Do you know whether plague extends more rapidly in breezy health camps, or in breezy temporary hospitals, than it does in the still and crowded localities of the towns?—I am not in a position to give an answer to that question.

17,028. You have no knowledge of that?—No.

17,029. You do not know whether it does or does not extend in camps?—No.

17,030. If I tell you that it does not usually extend in camps, whereas it extends very much more readily in crowded localities where there cannot be much movement of wind, how far do you think that will affect your theory?—The germs die when they are relieved from crowded localities; they are killed mostly by the sun. They are more exposed to the sun in that quarter than in the original quarter.

17,031. If they are killed by the sun how is it that infection may be carried by the wind?—I think they are all more or less diminished in vitality by the sun, but those that fall in damp places re-acquire virulent power, and so do mischief.

17,032. You have no other reasons to give for your theory than those which you have stated?—No, beyond that the first cases arose in a grain store, and the greatest prevalence of plague with the highest mortality occurred in the most exposed houses in the immediate neighbourhood, and in the direction of the prevailing breeze; and we had also something to go upon in the almost annual outbreak of plague in Garhwal, on the southern slopes of the Himalayas, where it is supposed to be associated with the grain storage under the houses.

17,033. You have nothing more to say about wind diffusion than these examples which you have given us?—Yes, I have something more to say. The Umarkhadi Jail, the Common Jail, is very close to this quarter. There was a tremendous mortality in the immediate vicinity of the jail. Meanwhile it did not attack the jail.

17,034. How did the wind blow with regard to the jail?—The wind blew right over the jail.

17,035. Towards the jail, from the infected district?—Yes.

17,036. Do I understand you to say that no cases occurred in the jail?—None for the first year.

17,037. How does that tally with your theory?—The jail is surrounded by a wall 20 feet high, and the germs are not derived from sources so high, generally, and the germs blown by the wind would strike upon the walls and not go inside as a rule. Some of them, no doubt, would fall, but these that did fall within the jail enclosure were destroyed by the sun, because in the jail I took very great care to keep the place absolutely dry, so that the plague germs could have nothing to revive them once they fell. I stopped all watering of the surface of the ground, and simply maintained as much dryness as I possibly could, and I used limewash.

17,038. Therefore wind-carried bacilli are killed by dry soil?—Not by the soil, but by the play of the sun on the dry soil.

17,039. That refers only to wind-carried bacilli?—Yes.

17,040. What about the bacilli which are not wind-carried?—I can hardly conceive of any bacilli spreading otherwise than by the wind.

17,041. You know that in crowded localities plague extends from house to house, and within houses, where the atmosphere is quite still, so that it overtakes a large area in a district where there cannot be much influence of wind?—In crowded places and narrow lanes there are many spots where the sun cannot reach. The sun is the great germicide in my opinion.

17,042. Have you any experience with regard to curative serums?—Yes.

17,043. What experience?—Plague broke out in the House of Correction late in January, and in February of 1897. That is four or five months after it had started in Bombay. I called in M. Haffkine to use his curative serum—which he kindly did—but the result, in my opinion, was negative.

17,044. Have you got the facts; will you please state what the facts are?—The facts are that as many died who were treated with the serum, as who were not treated with the serum.

17,045. What was the total number?—Altogether there were 34 cases. Half of them recovered. To put it shortly there was no beneficial result to speak of from the curative serum.

17,046. What was the incidence of the plague among these people, how many were affected?—Thirty-four people were attacked with plague and 17 died.

17,047. The result was that 50 per cent. recovered?—Yes, 50 per cent. recovered.

17,048. That is not unfavourable, is it?—It is very favourable.

17,049. Why do you say "very favourable"?—Such a low mortality to cases is rare. The figures include those who were treated with curative serum, and those who were not.

17,050. Will you distinguish between the one and the other? I should be glad if you will give us the following information; how many cases were treated; how many cases recovered, and how many cases died?—Six cases were treated with the curative serum; three died and three survived.

17,051. The result was unsatisfactory?—The curative treatment was unsatisfactory.

17,052. Will you give us any information you possess from your own observation with regard to inoculation?—From my own observation it was distinctly successful.

17,053. Can you give us the facts?—There was only a very small field to work on, because plague stopped suddenly in the jail.

17,054. Stopped after inoculation, or before?—The plague stopped in the jail altogether amongst the non-inoculated as well as amongst the inoculated. It stopped quite suddenly. There were 164 persons inoculated in the workhouse, including the jail staff, and there were 191 people who were not inoculated.

17,055. How many cases of plague occurred in these two places, in the workhouse, and in the jail?—There were 34 cases altogether.

17,056. How many cases occurred among the inoculated?—Among the inoculated there were only five cases, and two deaths. Mr. Haffkine very rightly cut off three of the five because they showed plague the day after, or two days after, inoculation. They never recovered from the fever of inoculation.

17,057. How many deaths were there among the non inoculated?—Among the non-inoculated were 12 deaths.

17,058. How many cases of plague occurred before inoculation was commenced in these places?—There were 17 cases before that.

17,059. Then out of the 34 there were only 17 which occurred after the inoculation?—Yes, that is so.

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17,060. How many of the 29 cases among the non-inoculated occurred before inoculation had commenced?—I think only three. After the inoculation we had 12 deaths among the non-inoculated—and only two, really, amongst the inoculated, if you cut off, as Mr. Haffkine did, the three that had plague the day after they were inoculated.

17,061. Can you tell us the ages of the people?—This will be given by Mr. King, Assistant Surgeon in the House of Correction.

17,062. (*Dr. Ruffer.*) I am not quite clear with regard to your figures. You had 327 prisoners, of whom you inoculated 164?—Yes.

17,063. Are these your own figures, or M. Haffkine's figures?—They are all the same.

17,064. In his evidence M. Haffkine says, 154. I want to know whether it is a misprint, or whether it is not?—I think M. Haffkine's figures are correct. There were other persons inoculated besides those M. Haffkine counted in the jail. There were some people in the House of Correction, and the staff.

17,065. How many in the House of Correction and the staff were inoculated? Perhaps by adding those to M. Haffkine's figures, we shall get yours?—Assistant-Surgeon King was asked by me to give the evidence required.

17,066. All the inoculations were made on January 30?—Yes.

17,067. Could you tell us the dates of the various cases of plague among the inoculated?—There were three attacked, and three died, amongst those who were inoculated on the 30th January.

17,068. I want the dates of these attacks?—It was like this: they were inoculated on the 30th January, and the inoculation fever merged into the plague fever: there was no differentiation between the two.

17,069. I want to know where the buboes were in the three cases in which the inoculation fever merged into the bubonic fever. Also, the ages of these three people, and the ages of all the prisoners?—Mr. King I have asked to give this evidence.

17,070. When was the next case among the inoculated?—There were the three cases on the 30th, which I have given you. Then there was one case on the 31st, among those who were inoculated. That person recovered.

17,071. What was the age of this person; and what was the position of the bubo?—26 years. The bubo was situated in the right axillary region.

17,072. Was there any other case?—The other case among those who were inoculated occurred on the 6th of February. That case also recovered.

17,073. Were there any other attacks among the inoculated?—Not besides the three. M. Haffkine cut the cases I mentioned out of the returns altogether, because they occurred continuously with the fever of inoculation.

17,074. But did the last two cases die?—Yes, besides the three that he excluded.

17,075. I will read to you what M. Haffkine says: "On the 31st January there were two cases of plague "amongst the non-inoculated lot, of whom one proved "fatal, and there was one case amongst the inoculated, "who recovered. On the second day after the "inoculation, on the 1st February, there was one case "amongst the non-inoculated that proved fatal, and "there was no case amongst the inoculated." ?—That is quite right.

17,076. There were no more cases among the inoculated till the seventh day, regarding which M. Haffkine says: "On the seventh day, the 6th "February, there were five cases among the non-"inoculated, of whom one proved fatal, and one case "amongst the inoculated that ended in recovery"?—Yes.

17,077. You said it was fatal just now. That is why I wanted to know?—There were two attacks, and no deaths.

17,078. You said two attacks, and two deaths?—I was wrong.

17,079. Could you tell us whether these prisoners were under exactly the same circumstances, the non-inoculated, and the inoculated?—They were under exactly the same circumstances. I took them out myself and they were all together on the platforms.

17,080. Have you a plan* of the jail showing the cells where all the cases of plague occurred?—Yes.

17,081. Did the inoculated and uninoculated cases occur all over the jail?—Yes. (The witness explained the plan to the Commssioners.)

17,082. How many prisoners are there in each cell?—Usually there are three or four, according to the size of the cells, which vary a great deal. There are from 640 to 760 cubit feet for each prisoner.

17,083. Have you any register showing who was in each cell?—I do not think so. It would not be very easy, because there were people coming and going constantly. We had them all out on these platforms.

17,084. Can you tell us when the inoculated prisoners left the jail; have any of them left the jail?—Almost all the prisoners in the jails in Bombay are not very long-time prisoners. They are almost all in for under one year.

17,085. Can you put in a table showing where the various people were in the jail at the time of inoculation, and when they left the jail?—There were a a hundred people transferred to Ratnagari Jail, and we transferred a great many of the plague cases amongst them—the cases that had recovered.

17,086. I want to know, when did the inoculated people leave the jail. How long did you have them under observation?—Mr. King will give this information.

17,087. Did you hear of any deaths amongst the inoculated and non-inoculated after leaving the jail?—I have no knowledge of them after leaving the jail.

17,088. (*Prof. Wright.*) I believe there was another epidemic of plague in your other jail; can you tell us about that?—That was in the following year—1898.

17,089. Could you give us the particulars of that epidemic? Inoculations, also, were performed in connection with that epidemic, were they not?—Yes.

17,090. Where you in charge of the jail at the time?—No; I was on furlough. I, however, have the details here.

17,091. Where did you get the details from?—I got them from the jail records. I have a statement here with regard to the plague epidemic.

17,092. Who was in charge of the jail at that time?—There were two. One was Dr. Barry, appointed to act for Dr. Collie who was appointed to act for me. Dr. Barry was at the jail at the time.

17,093. Where is Dr. Barry now?—He is on furlough.

17,094. Is he out of India?—Yes.

17,095. (*Dr. Ruffer.*) Did you mention anybody else?—Surgeon-Major Collie.

17,096. (*The President.*) Where is he?—He is in Matheran.

17,097. (*Prof. Wright.*) You say Dr. Barry was in charge?—Yes.

17,098. Is he in the Indian Medical Service?—Yes. I see the ages of all the plague cases are recorded.

17,099. Would you give us a brief summary of this epidemic of plague?—In the Common Jail there were 19 attacks in January 1898; one or two of them were attacked on the last day of December 1897, but they all lived into January 1898. Of the 19 attacks, nine died. Three of the persons who died were attacked before the inoculation was performed. Of the remaining 16 there were six deaths. The remainder recovered.

17,100. Is this a long-time jail?—It is a short-time jail—much shorter than the other one.

17,101. When did the first case occur, was the patient a prisoner who had been recently admitted to jail?—The first case had been 23 days in jail when he was attacked, on the 31st of December.

17,102. (*Dr. Ruffer.*) Perhaps the best way will be to read M. Haffkine's evidence to you, and ask you whether you agree with it. He says: "At the end of "December 1897, the plague broke out in the second "Bombay jail. There are two jails here, the Byculla "House of Correction mentioned already, and the "Umarkhadi Common Jail. Three cases of plague, all

* Not reprinted with the Proceedings of the Commission.

" of which proved fatal, occurred before inoculation " was offered to the prisoners. This was done on " Saturday the 1st of January, when the prisoners " were questioned as to their willingness or otherwise " to be inoculated. The whole number of them " volunteered. In view, however, of the novelty of " the treatment, and with the object of demonstrating " its harmlessness, and the extent to which it gives " protection, only half the prisoners were allowed to " undergo inoculation. To avoid making any special " distinction the whole of the 402 prisoners present on " that day were paraded in 10 rows, an officer was put " upon them, and every second prisoner, just as they " happened to have come and were seated in the rows, " was sent to the inoculation table and received the " inoculation. We have been emboldened by our " previous experience of the after effect of inoculation " not to refuse it to anyone who chooses to undergo " it. I mean to say, no condition of health is con- " sidered to disqualify person from being inoculated, " except his having fever or plague on him at the " time he presents himself for inoculation. By " accident, however, it happened that the officer in- " oculating noticed that a man had fever on him " when the actual injection was already performed; " his temperature was taken, and found to be " 102°F. While the inoculation proceeded one " came across another man, with an exactly similar " temperature, and who was left uninoculated. " Neither of these two men showed plague afterwards. " We quoted afterwards that almost incredible inci- " dent in order to emphasize the fact that in every " respect the inoculated and uninoculated prisoners " appeared to be under absolutely similar conditions, " but for the fact of inoculation. It was agreed with " the authorities that that day being Saturday and the " next Sunday, when no prisoners were expected to " work, if any of the inoculated required rest on " Monday, the whole number of the inoculated and the " uninoculated should be given leave in order that " there should not be a single circumstance which could " be pointed out as constituting a difference in the " conditions of the inoculated and the uninoculated." Have you any personal knowledge of that?—No, no personal knowledge.

17,103. Then M. Haffkine goes on: " It is because " in this instance every second man has been taken, " and because we did not wait for the volunteers com- " ing out of the crowd, as was the case with the first " inoculation in the Byculla Jail, that I consider this " experiment as having been made in more precise " order and under stricter conditions than the first " experiment. The whole lot of the prisoners were " taken in the order in which they came, without any " distinction of any kind being made"?—The second time he did that. He took every other man. I do not understand that, because there was such a number of the inoculated. 205 were inoculated, and only 70 were left uninoculated. I did not understand how he could do that. M. Haffkine told me that he inoculated every other man, and that he inoculated 205 out of a population of 275. I do not see how that came about. This was the second jail inoculation, but the first in the Umarkhadi Jail.

17,104. (*The President.*) Perhaps it was over two periods?—No, it was only once. I asked the Superintendent about that. He told me that he could not understand that. He wished to have them all done; but he suddenly remembered that he could not get all the bad ones looked after, if they were all done, so they left 70 out of the 275.

17,105. (*Prof. Wright.*) Who is the Superintendent? —Mr. Mackenzie.

17,106. Is he still here?—Yes.

17,107. (*Dr. Ruffer.*) Then M. Haffkine goes on to say: " Not to leave out anything, I must mention the " case of two prisoners who were not willing to under- " go inoculation, and who were left alone. It happened " in two instances, out of 402 persons who were there, " that when their turn came to be inoculated, because " they were second in the row, they said they did not " wish it to be done, and these two were not inoculated. " I consider this experiment in the Umarkhadi Jail as " presenting a complete elimination of the errors " inherent to observations in human communities " generally, I mean to say from the point of view of " the precision of the conditions of the experiment, and " as regards the infallibility of the results." Is that right?—Yes.

17,108. Do you agree that plague continued for a month?—Yes.

17,109. M. Haffkine says: " The plague continued for " about a month, and on 11 different days there occurred " 13 cases"?—According to my information there was a case on the 18th of March, one on the 18th of February, and one on the 10th of February amongst the inoculated.

17,110. I will read you the whole statement, and perhaps you will take a copy and work it out. This is what M. Haffkine says: " During that month a certain " number of prisoners were discharged, and others " admitted to the jail. Taking day by day the num- " ber of inoculated and uninoculated who remained in " the jail during that month of plague, from the " original group of 402 prisoners, the average daily " strength of the inoculated appears 147, and of the " uninoculated 127. The number of inoculated who " stayed in the jail all through the epidemic was " therefore larger by about one-seventh than that of " the uninoculated. All the 13 cases of plague occurred " among the prisoners of the original group who were " present in the jail on the day of inoculation, and no " cases occurred in those admitted since then. There- " fore the distribution of the cases of plague amongst " the inoculated and the uninoculated, represents the " distribution of the two original absolutely comparable " groups of people which I have described. 10 of the " 13 cases were amongst the smaller number of un- " inoculated, and six of these 10 died," Is that correct? —Yes, that is correct. Six deaths occurred amongst those after M. Haffkine had to deal with the jail, six deaths occurred among the non-inoculated.

17,111. " There were three cases among the larger number of 147 inoculated, and all three recovered." Is that correct?—Yes.

17,112. I believe you did not see the cases, so that you cannot tell us about the symptoms?—No.

17,113. Then M. Haffkine's account is substantially correct?—Yes. I would like to read you a few remarks I made on the inoculations in the two jails. It gives the mortality from all causes, as well as from plague. It is addressed to the Inspector-General of Prisons. The remarks are as follows:—

" The Inspector-General of Prisons is aware that I gave M. Haffkine the first opportunity of publicly testing the effect of his prophylactic serum, on the occasion of the outbreak of plague in Her Majesty's House of Correction. He will also remember that I took this responsibility on myself, as I did not see that he, as a layman, could authorise me in this regard. The Surgeon-General afterwards made it clear to me that his sanction to such dealing with the prisoners would not have been accorded. Fortunately the matter was entirely in the hands of the Inspector-General of Prisons; and I was aware that Mr. Filgate would support any measure that I could show reasonable grounds for adopting.

" The field of observation of the result of inoculation in the House of Correction was contracted by the speedy cessation of plague on the establishment of dryness within the residential portion of the jail. Still, the result achieved encouraged the prosecution of the work of inoculation, and thus eventually it obtained a wide acceptance. It has, indeed, succeeded beyond what my experience of it in the House of Correction led me to expect. And I had no further opportunity of personally observing its value as a prophylactic during my absence on sick leave. However, my doctrine of dryness as the most effective preventive of plague was not in accordance with the belief of those who successively held my appointment, and these gentlemen pursued quite a different plan, with the result that the Common Prison, which had hitherto almost completely escaped attack, despite its situation in the midst of the most severely plague-stricken spot of Bombay, became the scene of an outbreak of the disease. On this occasion recourse was had to prophylactic inoculation. I must here say that three prisoners were attacked before inoculation was adopted, and so they should be left out of account in judging the result of preventive treatment. Besides these three there were sixteen prisoners attacked with plague in the Common Prison in January of last year, and of these six died. Of the inoculated, four were attacked, and none at all died. I attach hereto a detailed statement*

* The statement referred to was not put in by witness. *See* statement put in by Mr. Mackenzie (App. No. LIX. in this Volume).

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of the men attacked, of deaths and recoveries. The three asterisks indicate the cases which preceded the inoculation, and which I have left out of account. I should add that a second inoculation was performed just four days before I returned to duty early in July last year; 205 persons were then inoculated, and only 70 left untouched. The result of this inoculation, curiously enough, was that one case of plague occurred among the inoculated, and the convict in question was transferred to the Arthur Road Plague Hospital, where he recovered; and two other minor cases occurred among the inoculated, and none at all among the other inmates of the jail, who already greatly outnumbered the remnant of the inoculated, the Umarkhadi Jail being a short-term one. By this time I had been three weeks on duty since my return from leave on the 9th July, and I had meanwhile put the jail back under my own plan of plague prevention. That is to say, I discontinued the practice described in the subjoined letter of the Superintendent of the Jail, and resumed my own simple plan of keeping the premises as dry as possible with pans of burning charcoal.

"'With reference to your enquiry as to the measures adopted to prevent the occurrence of plague in this prison during your absence on sick leave from 9th October 1897 to 9th July 1898; I have the honour to say that the practice of burning fires in the sleeping quarters was discontinued as superfluous, and that the precautions you took to maintain a thorough system of dryness and freedom from damp were quite departed from; the entire prison was frequently flooded with lime-wash, and twice daily, morning and evening, the sleeping rooms and the whole of the quadrangle of the prison were sprinkled with disinfectants. The entire prison, it may be said, was, in consequence of this application of moisture, in a condition of perpetual dampness, perhaps more particularly in places where the direct heat of the sun could not penetrate. It would not be out of place, I think, to mention here that in addition to the eighteen deaths which occurred under this régime, there was an abnormal number of prisoners constantly unfit for hard labour from sickness.'

"Lime-washing was also had recourse to at first, but finding that the subordinate jail executive could not be trusted with seeing that the lime-washed cells were properly dried with burning charcoal before they were again tenanted, I discontinued it, and for the last three months my whole concern has been to keep the working and sleeping quarters of the jail absolutely dry, and for this purpose I allow the sun's rays full scope, and where these cannot penetrate with force I have charcoal burnt, morning and evening, for the space of two hours each time. In my report on the outbreak of plague in the House of Correction early in 1897, I stated that that occurrence was due to my inability to restrain the dampness of the residential portion of the jail. And it was seen that when the dampness was obviated by the cutting off of the water outside the residential yard, the epidemic quickly—indeed, I may say abruptly — subsided. In that same report I remarked that no plague appeared, to speak of, in the Common Jail, because no water whatever was then delivered in the residential yard, and so I had no difficulty in keeping the place scrupulously dry. As I have said, however, this plan was not in operation during my absence on sick leave. My system was then replaced by one of which the daily sprinkling of the residential yard and sleeping quarters with a liquid disinfectant was a prominent feature. I here subjoin a tabular statement of the medical history of the Common Jail throughout the year; the first six months being under the régime which was not mine, and the second half of the year under the plan which was altogether my own.

Population - -	413·5	406·2	499·5	559·3	397·5	306·9	300·7	368·1	401·6	382·9	387·2	341·9
Months - - -	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Deaths - - -	8	2	2	2	2	2	0	1	0	1	0	1

"This shows a mortality of 18 in the first six months of the year (9 being plague cases) and only three in the last half of the same year. I am inclined to think that some of the cases of the remaining nine partook also of a pestilential nature; and this view of the case is strengthened by the fact that a second inoculation was deemed advisable at a short interval before my arrival in July last year. I would here, however, say that I do not for a moment wish to imply that the system pursued in my absence was not undertaken with a high sense of duty. And though it is my business at this moment to discriminate, I wish at the same time to put disparagement far from me. I specially wish this to be well understood, as I am given to understand that the measures in question had the approval of the Surgeon-General. I have no wish to do other than what is just and courteous to all men, and I therefore hope that my remarks on the course pursued by others shall be held altogether free from prejudice to anyone. I only wish to place in relief the fact that my plan of the strictest maintenance of dryness arrested the plague in the House of Correction in the Spring of 1897, and kept the Common Jail free from plague up to my departure on sick leave on the 9th October 1897; and that during my absence moist disinfectants were freely used in both places, with the result that there was a reappearance of plague and grave mortality in the House of Correction, and a fierce outbreak of the pestilence in the Common Jail, where it had not previously appeared. I would here say that plague seems to become weaker and weaker in successive years in any place attacked. And that it only broke out in the Common Jail in the second year of its prevalence, despite the strongly plague-stricken environment of the jail in question, shows that the means adopted for its prevention in the first year of its prevalence were effective, whilst the measures conceived for its prevention in the second year were abortive. This view of the case is further strengthened by the fact that the resumption, in July last year, of my simple plan of dryness, called such a decided halt in the mortality of both jails.

"Returning to the question of inoculation, I find that 138 inmates in the House of Correction were thus dealt with on the 3rd January 1898, there being then 128 other prisoners in that jail who were left untouched, and who thus served test purposes. Almost the whole of the 138 were inoculated after a short interval. As will be seen from the following statement, there were 11 deaths in the House of Correction in the first six months of the year.

Population - -	276	289	333	328	308	286	274	273	270	254	284	333
Months - - -	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
Deaths - - -	Nil.	1	4	4	1	1	Nil.	Nil.	1	Nil.	Nil.	1

Total Number of Deaths - - - 13.

Total Population - - - 3508.

"Of these 11, there was one case, that of Rama Gunpal, who had been inoculated two years running; his death was due to phthisis. There were altogether three cases of plague, two died and one recovered; all three were not inoculated. The remainder, nine, still left an enormous figure for the six months mortality of a small jail, and I may add, that of these nine cases, four were suspected at the time to be plague cases,

only they lacked pathognomonic plague phenomena, and were therefore not declared to be plague cases. It will still be observed that the mortality mainly decreased in March and April; and it should be noted that on the 7th of January 1898, the water which all the time since January, 1897, had not been allowed access to the residential quarter of the jail, was again let on, and remained on, till I stopped it early in July last, and at the same time had recourse to the burning of charcoal to overcome the dampness and keep the place as dry as possible. I here subjoin Mr. Hall's account of what was done in my absence.

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'MEASURES adopted for the PREVENTION, &c. of PLAGUE in the HOUSE OF CORRECTION during the period 16th October, 1897 to 15th July, 1898.

'From October to about the end of December 1897, white-washing and the burning of charcoal fires were continued. In the early part of January, 1898, the medical officer—Major Collie—recommended that quarters for the warders should be provided, that portions of the roofs of cells should be removed to admit sunlight, and that the white-washing should be more frequent.

'About the 7th January, 1898, the medical officer—Major Barry—recommended that, in addition to white-washing the walls, the floors of all the cells should be whitewashed twice a week, that the drains and latrines should be flushed with a deodorising antiseptic, and that the same solution should be sprinkled about the yards of the prison. The clothing and bedding of the prisoners was also to be steeped once a week in the antiseptic solution and suspected admissions were to be washed with carbolic soap. These measures were continued until the 14th June, 1898, when they were discontinued on the recommendation of the medical officer—Major Collie. The water supply, which was let in to the rotunda pipes about the early part of January 1898, was cut off about the end of July 1898, at the request of the medical officer—Lieut.-Colonel Waters.

W. HALL.
Superintendent H.M's. House of Correction.'

"As a result of the change from the wet to the dry system, a glance at the same tabular statement will show that we only had two deaths in the last six months of the year, *i.e.*, two as against 11 in the first six months of the same year. But it may be asked, was this not coincident with the general diminution of plague in the neighbourhood; and to this I answer, by no means. The plague diminished in prevalence through the hot months of April and May, and reached its minimum in the first few days of July. But it then began to rise again and displayed a fresh epidemic which lasted throughout the monsoon, reaching its maximum in October. Taking the two jails together, we get a mortality of 29 in the first six months of the year, and only five in the last six months of the same year; that is, a death rate in the thousand of 41 in the first case, and only five in the second. As to how far the mortality was arrested by inoculation, it is to be observed that there was no inoculation in the House of Correction since early in January 1898, and then only half of its inmates (including jail executive) were inoculated. And in July, most of the inoculated had been released on the completion of sentence, so it cannot be at all averred that the diminished mortality of two in the last six months of the year was in any way due to prophylactic treatment. Then, as regards the common prison, it being a short term jail, few, very few of those inoculated on the 4th July, remained in prison six weeks later. Here indeed, we saw that one inoculated man was attacked with plague, and sent to the Arthur Road Hospital late in July, whilst none of the non-inoculated prisoners were at all attacked, and meanwhile the latter numbered 250, whilst the remnant of the former (the inoculated), did not amount to 100. But, I wish it by no means to be understood from this that I am an opponent of inoculation. As already stated, I was the first to give M. Haffkine an opportunity of demonstrating the efficacy of his prophylactic serum, and I am proud of its subsequent success. I was unwilling at first to give a hasty credential to prophylactic inoculation; but now that I have had occasion to review instances of its extended and enhanced effect, I gladly accord my testimony in its favour. I would, however, at the same time, point out that still more success is bound to accrue on the wide application of the principle I have enunciated, as to the obviation of dampness in, and in the close vicinity of, inhabited places. The best, the very best plague prophylactic, is dryness. This is the main thing I have learnt in regard to plague, and though it may still seem to some people a very small thing, it yet enables me to do much; and am thus in a position to hold the pestilence at bay. And be it remembered that the two Bombay jails have severally the most severely plague stricken environment of plague stricken Bombay, each jail being in the centre of localities giving the maximum of mortality."

17,114. (*Prof. Wright.*) You said the men were inoculated a second time in jail?—Yes.

17,115. Why were they inoculated a second time?—That I cannot tell you. There were 18 deaths in the first six months of the year. I have told you of nine cases of plague. Eight of those occurred in January, and one in February, and there was one other case in February. March, April, May, and June, each had two deaths; they were not put down as plague deaths, but I suspect from the second inoculation taking place so shortly before my arrival, that there must have been a suspicion that plague was at work among them.

17,116. There were about 400 people present on the 1st January?—Yes.

17,117. And the population of the jail had sunk to 275 on the 1st July?—Yes.

17,118. Then second vaccination was resorted to?—Yes.

17,119. And 205 were inoculated?—Yes.

17,120. Do you know how many of those were second inoculations, and how many were first inoculations?—There was only one inoculation.

17,121. How many of the 200 who were inoculated in January were still in jail?—None.

17,122. Had they all gone out?—Yes.

17,123. And this is a fresh series of inoculations on perfectly fresh subjects?—Yes. I have told you that the Umarkhadi Jail is a very short term jail, three months being almost the limit of residence.

17,124. These are another set of primary inoculations in jail?—Yes.

17,125. What is the result of that?—We had no result at all. One case of plague occurred amongst the inoculated about four weeks later. About 70 persons come, and 70 persons go every week to Umarkhadi Jail.

17,126. (*Dr. Ruffer.*) Could you add to your evidence the dates on which the inoculated people left the jail?—Yes, I can furnish it from the jail records, I believe. Mr. Mackenzie and Mr. King will put it in.

17,127. Will you please add to your evidence temperature charts of all prisoners who were inoculated in the Umarkhadi Jail in January 1898?—I cannot find such record on the Umarkhadi Jail; we had too much to do to have time for such record taking.

(Witness withdrew.)

Major B. B. GRAYFOOT, I.M.S., called and examined.

Major B. B. Grayfoot, I.M.S.

17,128. (*The President.*) You are in the Indian Medical Service?—Yes.

17,129. What are your medical qualifications?—M.R.C.S., L.R.C.P., and the double qualification of Edinburgh.

17,130. (*Mr. Cumine.*) You have been for about nine years Secretary to the Surgeon-General of the Government of Bombay?—Yes.

17,131. I think you have brought a map* of the Presidency with you?—Yes, I have.

17,132. You have marked on these maps at each place where plague appeared, the date of the first imported case which was reported, and also the date of, the first indigenous case which was reported.

* Not published with the Proceedings of the Commission.

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have you not?—Yes, the date of the first imported case is marked in red ink, and the date of the first reported indigenous case is marked in black ink.

17,133. Do you think the map shows that plague spread very slowly or quickly in the Presidency?—Very slowly.

17,134. Does it seem to show that a good many places escaped indigenous infection, although they had imported cases?—Yes, it does show that.

17,135. Does it show at all the length of time that it takes for indigenous plague to appear in the town after the first imported case?—The first imported case is at one end of the scale and the first local case at the other, but between the first imported case and the first local case there were a varying number of imported cases, so that, to say the period between the first imported case and the first local case is the time it takes to make a place infected is not strictly accurate.

17,136. You do not mean to say that the indigenous infection necessarily came from the first imported case?—No, it came from the whole series of infection.

17,137. Is there any relation between the number of imported cases a place has had and indigenous plague appearing in it, or does it appear from these figures that indigenous plague is not the result of a regular bombardment of imported cases, but the result of arrival of a particular kind of plague?—I cannot really answer that, because we tried to find out the number of cases of simple bubonic plague, and cases of pneumonic plague. Of course we are dealing mostly with native subordinates in all these places, and their evidence is not always trustworthy. There has been another attempt made to get the number of imported cases which took place before the first local case. At present I cannot give you statistics on that point.

17,138. You mention in your précis of evidence that an outbreak of plague has generally been preceded by high mortality?—Yes; we have noticed that in several places in the Presidency.

17,139. May not that mortality have been plague unrecognised?—I think very probably, and also more efficient registration at the time of an epidemic caused more deaths to be discovered and noted.

17,140. Will you tell us if there are any respects in which the Civil Surgeon of the Bombay Presidency differs from the Civil Surgeon in other parts of India: is he the Civil Surgeon for the district, for instance, or is he rather the Civil Surgeon of the Civil Hospital at the Sadr station?—In Bengal, the North-West Provinces and Oudh, in fact, in all the northern part of India, and I believe in Madras also, the man is gazetted as Civil Surgeon of the district, and is supposed to be and is the head of the district from a sanitary point of view. He administers the dispensaries, he is supposed to travel every three months round his district, and I believe he gets death returns and sanitary returns, etc., He has an Assistant Surgeon as his assistant, a graduate of the Punjab or Calcutta University, whom he leaves behind when he is on duty inspecting any village or town, this man being gazetted to the civil dispensary at the headquarter station. The Civil Surgeon of a district in Bengal is, therefore, more or less a travelling officer, and has the whole district under him, and an establishment to do the clerical work. In Bombay that is not so. In Bombay the officer is gazetted not as Civil Surgeon of Dharwar or Belgaum district but as Civil Surgeon of Dharwar or Belgaum. In Bengal the district is the man's first charge; in Bombay it is the station. The consequence is, in Bombay the Civil Surgeon is supposed to inspect the dispensaries in his district once a year, not every three months. He also inspects the factories, but he has none of the administration of the district under him. All that is done by the Surgeon-General in the Surgeon-General's office, so that the system is quite different in every way.

17,141. Does he receives returns of births and deaths in the villages of the district?—As far as I know, he does not. He gets no returns from dispensaries at all. They go to the Surgeon General's office. That is done for the simple reason that the Bengal system cost a great deal more than ours does.

17,142. He is the sanitary adviser of the Collector for the district, I suppose, if the Collector consults him?—Yes.

17,143. Has he any executive sanitary authority?—No, except that when he is on a tour of inspection he is supposed to send in a sanitary report it the town is of a certain population. If he sees any glaring faults of water supply or conservancy they are reported on a sanitary form which he fills up at the same time that he fills up his report of the dispensary, and sends to the Sanitary Commissioner.

17,144. If plague appeared in a village in a distant part of the collectorate it would be the duty of the Assistant or Deputy Collector to go to the place at once. Would it be equally the duty of the Civil Surgeon to leave the Civil Hospital and go off to the village?—Not under present circumstances. In fact, we find very often that Civil Surgeons find it very difficult to inspect the dispensaries once a year, because when the time comes to go to the dispensary the idea is so imbued in every one that the Civil Surgeon belongs to the station, that if some lady is ill or something is the matter with somebody's baby, he is immediately asked not to leave the station; the people do not hesitate to give such reasons for asking the Civil Surgeon to remain at headquarters. I only wish to bring out the point that in this Presidency the man's chief sphere of duty belongs to the station and not to the district as it does in Bengal.

17,145. So that although plague did break out in a distant village of the district no report about it would go to the Civil Surgeon?—Probably he would hear of it first of all from the Collector's office.

17,146. If he wished to go to that village he has no Assistant to put in charge during his absence, has he?—He can leave his Hospital Assistant, but he has no medical graduate as the man in Bengal would have.

17,147. Side by side with the Surgeon-General and the Civil Surgeon there is a Sanitary Commissioner with Deputy Commissioners and vaccinators?—Yes.

17,148. And the one hitherto has not been subordinate to the other?—That is so.

17,149. (*Prof. Wright.*) The Civil Surgeon is not subordinate to the Sanitary Commissioner?—That is so, and the Sanitary Commissioner is not subordinated to the Surgeon-General. Those two are independent.

17,150. Does not the Civil Surgeon report to the Sanitary Commissioner on sanitary matters?—He sends him occasionally a sanitary report, but he is in no way subordinate to the Sanitary Commissioner; he deals entirely with the Surgeon-General. If he inspects a town with a certain population he fills in a sanitary report which goes to the Sanitary Commissioner, and he might answer any questions that he was asked about it, but he is no way subordinate to him.

17,151. But the Civil Surgeon is subordinate to the Inspector-General of Prisons, is he not?—In his sphere as Superintendent of a jail.

17,152. Why is he not subordinate to the Sanitary Commissioner?—Because he has no work to do with him.

17,153. (*The President.*) What reports does he send to him?—He sends reports always to the Surgeon-General of the sick in his hospital and of the surgical operations and an annual report of the administration of the hospital. They all go to the Surgeon-General and the Sanitary Commissioner only gets the sanitary report spoke of from Civil Surgeons.

17,154. Has he any work of a public health character apart from vaccination?—The Civil Surgeon has nothing to do with vaccination.

17,155. Has he any sanitary work?—Only in an indirect way. He is generally on the Municipality of his station, and he is frequently made the chairman of the Sanitary Committee, and in that indirect way he does a lot of sanitary work. He is always at the disposal of the Collector. He is supposed to be the Collector's official adviser from a medical and sanitary point of view but he has no direct connection with the Sanitary Commissioner.

17,156. (*Mr. Cumine.*) When a famine comes on who takes under his charge the hospitals and the famine works, the Surgeon-General or the Sanitary Commissioner?—According to the Famine Code the Sanitary Commissioner takes all charge of famine. The Sanitary Commissioner requisitions the Surgeon-General for medical officers and subordinates, which are put at his disposal, and the Surgeon-General has nothing more to do with them until they are sent back.

17,157. That disposes of the civil medical administration. Can you tell us about the medical

administration dealing with plague?—Perhaps I ought to preface my remarks by showing the great difficulties we had when plague came. The medical services in India are recruited on this principle; Government count the sanctioned appointments and give a man for each appointment; then they add 20 per cent. for leave, and 5 per cent. for casualties. That, in total, makes up the strength of the Indian Medical Service. At the end of 1896 and in 1897, we had famine, plague, and then afterwards a frontier war with us, and it is easy to see that the strength of the Indian Medical Service was hopelessly inadequate to meet such contingencies. What happened was this. The Government of Bombay asked the Government of India for more men, and they immediately requisitioned on the Military Department for officers; all leave was immediately stopped amongst civil and military officers, and everyone at home not on sick leave was brought out at once. In that way the full strength of the service was practically in India with the exception of a few on sick leave. The Bombay Government got from the Military Department 10, 15, or 20 officers, as many as we could get, and a proportionate number of subordinates. These were posted where they were most wanted, but we did not have enough. Then the frontier war came on just as we had arranged everything, and we had to give up the men lent by the Military Department. In order to meet the difficulty of the insufficient medical aid, the Secretary of State sent out medical officers from England. To meet the difficulty of subordinates, viz., Assistant Surgeons and Hospital Assistants, we re-engaged all the old pensioned Assistant Surgeons and Hospital Assistants. We got those who would come back and put them into the easiest billets we could, to allow the younger men to go on plague and famine duty. Further we engaged everybody who had a medical qualification of any sort, and in that way we got over as best we could the frightful difficulty we had. Then if we had plague in one Collectorate and another Collectorate free, we closed as many dispensaries as we could in the one Collectorate and fed the infected area in that way. Honestly speaking, the whole medical administration of plague was more or less of a make-shift arrangement, simply because there were not enough subordinates and not enough medical officers. The difficulty of want of medical officers had been materially overcome by bringing men out from England. The medical subordinate of India, the Hospital Assistant and Assistant Surgeon, is an Indian product. There are a certain number of them and you cannot make more of them. It is now six months since I left the Surgeon-General's office, and I believe the difficulty is just the same. For three years not one of the subordinates has had leave, although as a great favour they have been allowed ten days casual leave occasionally. That is the way the principle of getting medical aid has been met. But as I say, it has been more or less of a make-shift arrangement because we have had to shut up dispensaries to send men to infected areas and never had enough subordinates to meet all demands for them.

17,158. Will you tell us about the flying columns which you organized?—In many places we did not have any medical subordinate of any kind. The original constitution of the flying column was supposed to be a Commissioned Medical Officer or an English doctor, two native assistants, if possible a female Hospital Assistant (this was very seldom possible), a couple of muccadums of disinfection, and 20 or 30 trained coolies, who had been trained in disinfection. We generally got them from men who had worked in Bombay city.

17,159. When a Collector telegraphed for them, you sent them up with their buckets and disinfectants and pumps, and so forth?—We had a regular equipment. We always tried to keep one column in advance. If we had a telegram from a Collector asking us to send up a flying column we sent it up with the coolies, and we immediately started equipping another one, teaching the subordinates, coolies, and all the rest. Of course the constitution of the flying column varied. If it was a little place we would not send a Commissioned Officer, but perhaps a medical subordinate; but the idea of the flying column was that they were to go to the place and immediately form the nucleus of a trained agency to meet with the plague, and to have all the implements and everything ready at hand.

17,160. The Surgeon-General and the Civil Surgeon inspect hospitals aided by Government, throughout the Mofassil generally. Has the Surgeon-General any right to inspect the hospitals in Bombay city?—All the hospitals are Government hospitals except one.

17,161. I mean the Municipal hospitals in Bombay city?—He has no jurisdiction over them. Of course, as a matter of courtesy, he could go and see them, but he only gets returns from them once a year for his annual report, and then he has to ask the Government to get them for him. As a matter of courtesy, if he goes to a Municipal dispensary there is never any objection made to his inspection, but as far as I know, he has no right to go and demand it.

17,162. (*Prof. Wright.*) Is there a Sanitary Board in Bombay?—Yes. The Sanitary Board consists of the Sanitary Commissioner of the Government and the Engineer.

17,163. What does the Sanitary Board do?—As far as I know, it has now assumed the advisory functions to the Government, which the Sanitary Commissioner used to have before. As far as I understand, it advises the Government on all matters, such as water supply of big towns and drainage schemes, and it collects and publishes a large sanitary report every year.

17,164. Are there only two members on the Sanitary Board?—Yes.

17,165. What happens if they disagree?—I do not know. At present, I believe, the Sanitary Commissioner is to be put under the Surgeon General, and the Surgeon General is to be made the President of the Sanitary Board, but there is nothing in black and white; it is not yet settled, I believe.

17,166. Who is the Sanitary Commissioner?—Lieutenant-Colonel Clarkson, now on furlough.

17,167. Who takes his place in the interval?—One of the Deputy Sanitary Commissioners acts for him.

17,168. On what principle are the Sanitary Commissioners selected? Are they selected for eminence in bacteriology?—Lieutenant-Colonel Clarkson has been 14 or 15 years in the Sanitary Department, he is not, as far as I know, an expert in bacteriology.

17,169. What is the Sanitary Department?—The Sanitary Department of Bombay consists of a Sanitary Commissioner and five or six Deputy Sanitary Commissioners. The whole Presidency is divided up into sanitary circles, and each Deputy Sanitary Inspector has his circle. Their chief function and most important work is vaccination. They have all the vaccination of the Presidency under them, and that, I think, forms the major part of their work. Of course, I am not in the Sanitary Department.

17,170. Who selects the men for the Sanitary Department?—As a rule the officers of the Sanitary Department are chosen by the Sanitary Commissioner himself in conjunction, generally, with the Surgeon General, who recommends to Government, because the Governor appoints every one.

17,171. Are these appointments financially desirable appointments?—No, they are not particularly well paid.

17,172. Are they sought after?—No; they used to be paid better than they are now; because they used to have a fixed travelling allowance in the old days, now that is cut. The Sanitary Commissioner to the Government of Bombay starts with Rs. 1,200 a month, and the Engineer gets Rs. 1,400, I think.

17,173. Does a member of the Indian Medical Service do himself financial damage by going into the Sanitary Department?—I would not say that.

17,174. But at any rate, he does not advantage himself?—The man in the Sanitary Department is travelling in the jungle for seven or eight months in the year, during which time he has very few expenses; he meets very few people; there are no social calls on his money, and he can, practically, live very cheaply.

17,175. But if these appointments are not sought after, I presume they are not worth having; is that the state of things?—No, I do not say that. Many men like them. I know one man who told me he would refuse any good Civil Surgeonship, because he preferred to be in the Sanitary Department.

17,176. Has a medical officer to get the Diploma of Public Health, or study bacteriology before he is admitted in the Sanitary Department?—I believe it will be so now, but the majority of men, Colonel Clarkson for instance, were in the Sanitary Department before bacteriology was an important subject or taught in the medical schools.

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17,177. Then at present no qualification in bacteriology is required?—Knowledge of bacteriology is not made a *sine qui non* now, but, as a matter of fact, many of the men coming in here had sanitary diplomas.

17,178. When the Surgeon-General wants advice on sanitary matters, such as disinfection, does he go to the Sanitary Commissioner?—No.

17,179. Where does he get his information from?—I think the Surgeon-General knows as much about disinfection as the Sanitary Commissioner.

17,180. I understand the Sanitary Commissioner is supposed to be a specialist, and the Surgeon General is supposed to be a purely administrative officer; does he not go to any specialist to get information on disinfection?—The Surgeon-General is the adviser to Government on all medical subjects. The last time we had to do a great deal with disinfection, we consulted M. Haffkine and Mr. Hankin, and every conceivable source we had.

17,181. But you have no official adviser?—No official bacteriologist.

17,182. Is there no bacteriology connected with the Sanitary Department?—No Government bacteriology. The only real laboratory we have is the one in the Jamsetjee Hospital; which is for the use of the Professor of Physiology and the Professor of Pathology.

17,183. And the Sanitary Department has not any laboratory at which bacteriological work can be done?—It has no experimental laboratory.

17,184. Supposing you want to know whether a particular disease spreads by air, wind, or water, or anything of that sort, whom do you ask?—We do not ask anybody. At present we can ask M. Haffkine to report on any subject, but before he came to Bombay we had nobody, and we have no institute and no Government bacteriologist for Bombay Presidency, whom we could ask to carry out a series of experiments on the life history of anything.

17,185. Has it been represented to Government that you want information and cannot get it? I presume you represent the Surgeon General's office? Has it ever been represented to Government that advice is wanted on matters of this kind?—I do not know; I am not aware that the Surgeon-General has made any special representation that he requires an adviser in bacteriology. The question has been, I believe, considered by Government, who know what is required.

17,186. Were the flying columns, of which you spoke, under the Surgeon-General?—Yes.

17,187. Not under the Sanitary Commissioner?—No. The rule was that the Surgeon General equipped them and they were sent to various places, and the medical officer was supposed to work in conjunction with the local revenue officer, that is to say, the Assistant Collector, or whoever was the head of the Civil administration.

17,188. Was the Medical Officer in charge of the flying column trained in bacteriology?—No; he was very often a Hospital Assistant or Assistant Surgeon, or anybody we could get. It was very seldom we could get a Commissioned officer.

17,189. Had you any guarantee that he knew anything about disinfection when he set out?—He knew as much about disinfection as most medical men do.

17,190. How much is that?—That varies according to the man.

17,191. No steps were taken to see that he had more knowledge of the matter than the average medical man?—No, we could not do it, because we were working at high pressure and had to take any man we could get. We had these sudden calls upon us, and our subordinates had not been trained in bacteriology. The medical officer had had practical experience of disinfection of houses with an acid solution of perchloride, and his coolies under him had been trained in the use of the wooden Chinese pumps, and all the technical details of disinfecting a house. We do not pretend they were scientifically perfect columns, but what we maintain was that they were the best means at our disposal of supplying a trained agency in those jungle places where they went.

17,192. Then these men simply knew how to use a pump and how to pour on a certain fluid?—They could not take the sweepings off the floor and tell you if there were bacilli there, but you could not expect that. As I say, they were not scientifically perfect, but they were the best we could get with the material at our disposal to meet the difficulty of plague breaking out in small places where the people know nothing. We sent Captain Lenmann to Lanauli, and of course the columns were fairly good when we had medical officers going with them, but in some jungle places we only had a Hospital Assistant and perhaps 20 coolies to start the nucleus with the Mamlatdar, the village constable and the Patel.

17,193. Were these so-called flying columns reported upon by the Surgeon-General as being trained columns or did the Surgeon-General say they were not trained?—He called them flying columns; we never pretended at the time they were perfect.

17,194. Were their imperfections fully reported?—No, there was no need to do that because Government knew it as well as we did. All Collectors know the capabilities of a Hospital Assistant and an Assistant Surgeon, because they deal with them every week. If we had gone on reporting on our own imperfections in the way of all the things we wanted, we should have been reporting all day long, because when you have famine, plague, and a frontier war all on at once, you must be disorganised. In India in normal times the policy of the Government is only to have a sufficient number to do the actual work of the country, leaving a small margin for deaths and leave.

17,195. (*The President.*) These columns which you sent out were not expected to do original investigation?—No; they were just simply to meet the local requirements of the place.

17,196. They were not expected to do original investigations under the circumstances, even though they were able to do it?—No.

17,197. They required sufficient training merely to carry out the best method of disinfection?—Yes, and they were supplied with all our instructions. We issued instructions in disinfection which we had drawn up after we had had elaborate experiments done by Mr. Hankin on the question of the best disinfectant.

17,198. Supposing you had a large number of trained bacteriologists in India, it is not at all probable that you would have told off one of these men to each of the flying columns?—It is a thing I should never have thought of doing for one moment.

17,199. You spoke of the functions of the Sanitary Commissioner; he has a Deputy, I understand?—Yes, five Deputies.

17,200. Each of whom has a district under his immediate control?—Yes.

17,201. How large is this district?—The district generally consists of two or three collectorates. As a matter of fact the districts are rather large; they cannot get round their whole district during one touring season. The touring season generally commences at the beginning of October and goes on to the end of May. They have no time to go round the whole district in a year; it generally takes them two to three years.

17,202. You stated that the functions were largely to look after the water supply and large schemes of conservancy?—Any sanitary function of that kind—the ordinary advisory powers of a Health Officer at home, and on the same things that he would advise his Corporation about. He would point out obvious mistakes in the water supply. For instance, if they saw that the local authorities had placed the village latrine above the inlet where they take the water, they would point that out. They would advise on any local sanitary work, but, as I said before, I think their best and greatest work is vaccination.

17,203. Who else does sanitary work officially?—The Sanitary Commissioner and his five Deputies constitute the official Sanitary Department of this Presidency.

17,204. There is no one else officially connected with it here?—No. Every Civil Surgeon is supposed to be the medical and sanitary adviser of his Collector; that is to say, if his Collector had in his district, or in his special town, anything that he saw was wrong, he would ask his Civil Surgeon what he thought about it, and if it was sent up officially to Government it would then immediately fall into the Sanitary Department's hands. The Civil Surgeons do a lot of sanitary work because they are generally in the Municipality of their station, frequently chairman of the Sanitary Committee, and in that way they do a great deal in the way of helping the Municipalities with their advice.

17,205. Who looks after such questions as overcrowding, ventilation, and so on, in houses?—If it came under the Civil Surgeon's notice, if he saw any epidemic disease he would report it to the Collector, but there his functions would cease. He could do nothing.

17,206. Supposing there was no epidemic disease, and nothing to draw his attention specially to the condition?—He would report it once a year when he made his annual sanitary report, that in such and such a quarter overcrowding was very great, just as the Health Officer to the Bombay Municipality has for years reported that there is overcrowding and insanitary chawls in Bombay; and they still exist.

17,207. Whom would the report go to?—The report would go to the Surgeon-General's office, and when he saw it he would send it on to the Collector of the district, and request him to do anything he could to remedy it, and the probability is that nothing would be done for the lack of money.

17,208. The Collector would have the ultimate decision?—The Collector, as the head executive and revenue officer of the district, must take the initiative. The Sanitary Department have no power. They can only advise. They have no power to insist on anything being done.

17,209. Suppose the Collector does nothing and the sanitary official is still impressed with the insanitary condition, what more can he do?—He can report to the Sanitary Commissioner that he has recommended certain measures, and that nothing has been done, and the Sanitary Commissioner can refer the question to the Government.

17,210. That means to whom?—To the Governor and Council. He would write to the Secretary of the Government in the General Department, reporting the whole case, and the ultimate decision must rest with the Government whether any action is to be taken or not.

17,211. In a good many instances such reports, I believe, have been sent to the Collector?—The reports are going on all the year round on this point.

17,212. Do you know of any cases in which any action further than that has been taken?—In the majority of cases nothing further has happened; the Collector might want to do it, but he has not the money to do it.

17,213. In a good number of cases nothing has been done?—If you look up the records of the Sanitary Department of this country you will see there has been a most valuable lot of advice given with very little action, because, although the Government and everybody are most desirous to do these things, every sanitary reform resolves itself into a question of money.

17,214. Therefore, your answer is that in a large number of cases these reports have been sent in and no action has taken place?—Yes.

17,215. With regard to these cases in which no action has been taken, do you know if the person who originally sent in a report, that is the sanitary official, has done anything further?—I cannot tell you that. I do not know it within my own knowledge.

17,216. (*Dr Buffer.*) Did you say the Sanitary Board consist of the Sanitary Commissioner and the Engineer?—Yes

17,217. How often does the Board meet?—I cannot tell you that.

17,218. Do you know of any great work or any improvements which have been the result of the action of the Sanitary Board?—I am not in the Sanitary Department and I really do not know. The only way I knew of the actions of the Sanitary Board was, that when a dispensary was to be built or anything of that kind done, it fell within the Surgeon-General's jurisdiction, and very often a reference was made upon it to the Sanitary Board and to the Surgeon-General. In that way I get to know what was going on in the Sanitary Board, but I really had nothing to do with it. And my knowledge in this regard is not complete.

17,219. Can you tell me what the total population of the province of Bombay is, roughly speaking?—About 19 or 20 millions.

17,220. There are five Deputy Sanitary Commissioners?—Yes.

17,221. How many Civil Surgeons are there?—Twenty-four.

17,222. How many dispensaries are there?—Taking the Municipal dispensaries as well as the State-aided dispensaries, I think there must be very nearly 300. We have 283 Hospital Assistants who have appointments, and then we have a reserve of 56, and in that reserve there are some who are employed in dispensaries. The reserve is supposed to be kept for leave, but now it is all employed on plague duty. We have, to quote exact figures, 296 dispensaries and there are 87 dispensaries in Native States in the Bombay Presidency.

17,223. What towns do you choose for dispensaries?—We place dispensaries in the headquarters of a district. In the Dharwar Collectorate, Dharwar is the head station of the place, and we had the Civil Hospital there; then in all the large and important towns like Hubli and Gagad and in all the Taluka towns, that is, in every sub-division of a Collectorate, we try to have a dispensary.

17,224. What is the smallest town in which you have a dispensary?—They go down to 3,000 and 4,000 people with a daily attendance of only 30 or 40 people.

17,225. Do the people get their medicines for nothing?—The medicines are supplied from the Government Medical Stores, and are paid for by the Dispensary Fund, which is made up by a grant from Government, a grant from the Local Board and a grant from the local Municipality. The poor get free advice and medicines.

17,226. Does the Civil Surgeon, the Sanitary Commissioner or the Hospital Assistant, or anyone connected with the sanitary service at all, ever visit the smaller villages?—The Sanitary Commissioner visits places of importance, his Deputies go everywhere checking vaccination returns, &c. The Civil Surgeon only visits dispensaries in his district.

17,227. What does the deputy Sanitary Commissioner examine in each village?—He has to check the local vaccinator's returns, but of course, members of the Sanitary Department can give you more minute details than I can.

17,228. What system of notification of infectious diseases have you?—We have no system.

17,229. What system of notification of deaths have you in the province of Bombay?—I think it is chiefly a matter of the police.

17,230. No sanitary officer concerns himself with deaths unless they are brought to his notice?—No, and has nothing to do with them, as far as I know.

17,231. Unless the Head man of the village chooses to report it, nothing is known?—I should imagine so.

17,232. So that plague, for instance, or any infectious disease might be going on in villages for six months without anybody being any the wiser?—That is a point I brought out. We had high mortality in many villages, and from the Surgeon-General's office we told them that there must be plague amongst them. Frequently they denied it, and then it was forced upon them afterwards.

17,233. (*The President.*) You would only know it in the event of the mortality rising above the average mortality to a distinct degree?—Yes.

17,234. And, of course, plague sometimes occurs without such a rise?—Yes.

17,235. (*Mr. Cumine.*) The village Head-men are bound to report the outbreak of cholera or small-pox, I believe?—Yes; they are bound to do it, and, as a matter of fact, cholera is almost always reported.

17,236. Supposing the Sanitary Department told the Collector that in a particular village or Municipal town there was a great deal of over-crowding, has the Collector any legal power to remedy that?—That I do not know; it is a question of the Municipal Act: I should think he ought to have, but I do not know whether he has.

17,237. Do you think he has, as a matter of fact?—I do not know what the Collector's powers in that regard are.

17,238. Do you think the Collector stands principally in need of information that a place is dirty, or in need of money and agency to make it clean?—I think that in India at the present time what is wanted is not so much trained agencies, because we have them now, but what we want is money for works. The trained agency at the disposal of the Government is quite good

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enough to advise for all the sanitary requirements of this country so far as I can see, for many years to come. What is wanted is money.

17,239. (*Dr Ruffer.*) Surely it would be better if you could have a system of notification and registration?—Minor details of that kind, if it can be done, might be instituted, but any large sanitary schemes, such as having a trained bacteriologist at every headquarter town, any gigantic scheme of that kind would be of no use. In every place any doctor can see what is required, from a sanitary point of view.

17,240. I should not call the notification of disease a minor detail?—Those details we might have, but any tremendous Sanitary Department such as you have in Great Britain we do not want.

17,241. (*The President.*) How long has the present Sanitary Department been in existence?—Certainly 20 years in this Presidency. I cannot tell you for the whole of India.

17,242. The great barrier for doing work has been absence of funds?—Yes, and also there are other things which are a great drawback in India. We have no Medical Act, and lots of disadvantages like that. Anybody in India can practise medicine or surgery.

17,243. Is there any immediate or early prospect of the requirements being met if there is want of funds?—I do not think there is.

17,244. Has that barrier of want of funds been found sufficient to prevent very large sums from being expended in Bombay and elsewhere during these epidemics on sanitary improvements?—I think very large sums have been spent in the epidemics of plague, and in that way the Government have done all that they could do.

(Witness withdrew.)

Mr. F. M. Gibson.

Mr. F. M. GIBSON recalled and further examined.

17,245. (*Dr. Ruffer.*) The last time you were before us you gave us some evidence about the bacteriology of plague in human beings and rats, and also an account of an attempt to trace the bacillus in nature: have you anything to add to your bacteriological evidence?—I have no further evidence to add in that direction, but the investigations have been, and are still being, proceeded with.

17,246. Have you any more facts which you would like to put on record?—I have noticed recently in rats infected in Bombay an affection of the lungs which, I think, is important as an indication of how rats get the disease.

17,247. Will you describe that?—The lungs in an ordinary rat which has died of plague are usually found collapsed and pale. In the rats which I saw at the beginning of last month the lungs completely filled the thoracic cavity, and showed hæmorrhagic patches, and on section they were found to be tremendously engorged with blood. I failed to get the plague bacillus from the sputum, but it was very obviously present in the blood and the liver. I think it must have been in the sputum, although I failed to get it.

17,248. What is your conclusion?—I think it likely that these rats contracted the disease by inhalation of infected material. So far, I have found the bacillus in the blood of the rat, and also in the urine and the fæces.

17,249. How did you obtain plague bacilli from fæces?—Simply by smearing on a series of agar tubes, and isolating colonies in that way. The intestine was scorched through with a hot iron, so as to avoid contaminating with the blood in which the plague bacillus is, of course, present. Then the fæces were removed from the intestine with a needle.

17,250. How did you ascertain that the bacillus got from the fæces was really the plague bacillus?—That was isolated by smearing a sufficient number of tubes, and getting isolated colonies. Pure cultures were obtained, which were injected into rats, and the rats died of plague, and pure bacilli were recovered again.

17,251. What further conclusions do you draw from these observations?—That the rats are probably instrumental in infecting localities. I do not know how they do it.

17,252. Do you think the rats acquire the disease by inhalation?—I certainly think so in these rats which I got at the beginning of last month.

17,253. Not always?—No; these rats showed a special implication of the respiratory organs.

17,254. Have you any experiments to show that rats can be easily infected through the nose?—No.

17,255. Have you any more experiments with regard to rats becoming infected by feeding with plague cultures?—I have experiments going on, but they are not complete.

17,256. When you were here before, you said you would see whether rats contracted the disease by feeding on other rats dead of plague; have you made that experiment?—I only once got a rat which died after eating part of another rat dead of plague. It died within 10 hours of the original plague rat, and we were unable to recover the germ. Probably, I should say, it died of toxine poisoning.

17,257. They are all the experiments you have made on that point?—Yes.

17,258. Have you any other bacteriological points you would like to put forward?—I have some remarks regarding the occurrence of the bacillus in man. I found it always in the blood of dead patients and always in the sputum of patients who have died of the pneumonic form. Once I recovered it from the urethra of a patient who had died of the bubonic form.

17,259. In how many cases did you examine the urine?—Not more than five.

17,260. In bubonic or septicæmic cases?—Bubonic.

17,261. In how many cases did you find the bacillus?—In one.

17,262. Did you find the bacillus in the fæces?—No, I have never succeeded in doing that.

17,263. Did you examine the case in which you found the bacillus during life or after death?—After death.

17,264. Have you any other facts you would like to give us?—That is all as regards human beings.

17,265. (*The President.*) Have you found any bacilli in the sputum of bubonic cases?—No, only in pneumonic cases.

17,266. You have examined the sputum in many bubonic cases?—Yes.

17,267. And the results have been altogether negative?—Yes.

17,268. With regard to pneumonic cases have you found the bacilli in any excreta except the sputum?—No.

17,269. You have searched for it in the urine?—Yes.

17,270. And in the fæces?—Yes.

17,271. And you have failed to find it?—Yes.

17,272. Although in the same cases you have found it in the sputum?—Yes.

17,273. (*Dr. Ruffer.*) Have you made any other attempt to trace the bacillus in nature?—I have not completed any.

17,274. You have nothing you wish to put forward at the present moment?—M. Haffkine asked me to give some evidence with regard to the testing of the prophylactic.

17,275. Will you kindly give us your evidence as to that. In the first place, since when have you begun testing?—From December. The plague prophylactic is a broth containing chiefly albumose in solution inoculated with plague bacillus, and it is then grown for a period of from two to six weeks. Such flasks as show sufficient growth are then sent to be tested, and that was the work on which I was employed during December.

17,276. Are the flasks tested before sterilization?—Yes. The testing consists of drawing a small portion from the flask with a capillary pipette and smearing that on the surface of a specially prepared agar. It is of great importance to have the agar of a rather dense consistency and well dried. If it is not dry the growth is not characteristic, and it is difficult to see if there are foreign organisms present. Then the agar tubes are incubated in ordinary room temperature in Bombay, namely, 80° F., for three or four days. The growth of plague

thus obtained is quite characteristic. During the month of December I examined some 650 flasks, and of these, 50 were rejected as showing contamination with other organisms. That is a large number to be rejected, but it was chiefly owing to our having only a faulty form of flask with a rather wide neck. Latterly we have got into use a large flask with a very narrow neck. As showing the advantage of this I may say that the last 140 flasks which I examined showed no contamination at all. As to the nature of the contamination it was most frequently a yellow sarcina.

17,277. That is the only test which you have applied before sterilization?—Yes. After sterilization I also examined the flasks and only once found a living organism; but the contents of this flask were rejected as a result of the first test (before sterilization at 65° C.), the same contamination being present. It turned out to be a spore-bearing bacillus which had accidentally got admission. With this exception I never found a living organism in the material immediately after sterilization.

17,278. How was that examined?—It was examined in the same way on agar tubes.

17,279. Did you examine the contents of the flask which had been sterilised or the contents of the small bottles ready to be sent out?—The routine is for the decanters to inoculate an agar tube during the process of decanting a flask; every such tube is incubated for three days or more, and then examined by one of the staff of the laboratory, and the brews corresponding to those which are found contaminated are subjected to further examination with small bottles.

17,280. That has been going on since December?—Yes.

17,281. How much do you inoculate in each agar tube?—If you have sufficiently large tubes, and well dried-out agar, you can inoculate from ¼ to ½ c.c.

17,282. Is that after the carbolic acid has been added?—Yes.

17,283. You have found a living organism only once?—Yes. The spore-bearing bacillus above referred to.

17,284. You do not examine each bottle separately after the prophylactic fluid has been decanted into it?—The large number of small bottles renders this impracticable, with each batch of small bottles placed in the sterilizer there was always a large flask of unsterilized broth. If this control broth remained sterile it was judged that the small bottles would also be sterile. The testing of small bottles I speak of refers to experiments carried out with a view to estimating the adequacy of the above test.

17,285. You do not re-sterilize the fluid after decantation?—No.

17,286. Have you anything else you would like to add?—That is all with regard to bacteriology.

17,287. Practically, your opinion comes to this, that Haffkine's fluid at the time it is being decanted is sterile?—Yes.

17,288. You are ready to give us some evidence on other points not connected with bacteriology, as, for instance, the detection and information of plague. We have had a great deal of evidence on that; have you anything special to put forward?—I have nothing special. I have noted, in my précis, instances of plague in relation to particular houses. I had hoped to give a complete series of figures with regard to the houses in my district as to the nature of the floors.

17,289. Can you give us the general results?—The figures are not complete, but I thought I might cite the case of two large houses which are in contiguity; one has stone or cement floors, and the other house has earthen floors, and is also densely populated, but not so much so as the first house. The first chawl contains about 300 rooms, and a population which varies from 2,000 to 2,500. Up to the 31st December 1898, two years and two months from the appearance of plague in the district, there were 18 cases of plague in that one chawl. In the neighbouring chawl, which was much smaller, there was a population of 300; that has been vacant since November 1897. It was first vacated in June 1897, and then re-occupied, and finally vacated in November 1897. There were 14 cases there in one year.

17,290. To what do you attribute the difference between the two?—There is very little difference except the nature of the floors. The races inhabiting the two houses are different—there is something to be said for that. The larger chawl is mostly Pathans and Musalmans, whereas the smaller house is chiefly occupied by low-caste Hindus, among whom plague is more prevalent.

17,291. (*The President.*) Which house had the larger per-centage of cases?—The one with the earthen floors.

17,292. (*Dr. Ruffer.*) Have you anything to tell us with regard to the floors?—With reference to disinfection in the district, I always used a half per cent. acid solution of perchloride of mercury. I think it would be better to use an even stronger acid solution. I think, considering the nature of the floors which are constantly giving up ammonia, acid is one of the most important ingredients of the disinfecting fluid. I do not think it is possible to say yet what effect this disinfection has had. In my district there were 1,344 houses. Of these, up to the 31st December last, 803 had had plague cases.

17,293. How many had plague cases after disinfection?—That would be difficult to say. All the houses in which plague cases had occurred previously would be partially disinfected, *i.e.*, the room and the neighbouring ones to it in which a case had occurred. One hundred and ninety-six had plague cases in two epidemics, and 17 in all three epidemics. The third epidemic has not run its course yet.

17,294. Are you speaking of disinfected houses?—Many of them are partially disinfected. There are 590 houses in which cases occurred in one epidemic.

17,295. Have you any evidence with regard to health camps?—The first health camp in Bombay was opened in my district about the middle of December 1897, and the average number of inhabitants in the camp was 500 during the time I was in the district. It was in the middle of an infected area. Plague cases occurred in the camp on 13 different occasions, all the cases occurring in people who had been less than 10 days in camp, or about whom I was able to obtain a history of their having slept outside the camp. It was not a segregation camp, but it was a camp in which the people had free ingress and egress. I never found that one case in the camp could be traced to another in the camp. I found that taking off the roof of the hut was an ample means of disinfection. Since I left the district in May of last year two cases have occurred in the camp in all the residents.

17,296. (*The President.*) How did these cases orignate in the camp?—The people are allowed free ingress and egress, they might get infection outside.

17,297. (*Prof. Wright.*) Before December had you ever examined the prophylatic as to its sterility?—No.

17,298. Have you ever seen a bottle sent back as suspicious?—No, they are not generally returned. I have not seen any.

17,299. You test the contents of the flask after sterilization by introducing half a cubic centimetre into an agar tube?—It is generally run directly into the tube from the flask.

17,300. Is it the first or last portion of the contents employed for the test?—It is usually in the middle.

17,301. With regard to the addition of carbolic which is made to the prophylactic, we have it from other witnesses that certain of the bottles have been found to be putrid; do you think there is any possibility of the carbolic having ever been omitted from these bottles?—I do not think so: the carbolic is added to the flask.

17,302. In testing the sterility of the prophylactic, do you dilute so as to get rid of the effect of the carbolic, or do you run the undiluted carbolized vaccine on to your agar tube?—It contains half per cent. of carbolic.

17,303. Do you think that the carbolic which is present may prevent the bacteria from growing on your agar tube?—Yes, it delays development.

17,304. But ultimately the carbolic would, you think, evaporate, and then the bacteria, if present, would grow?—Yes.

17,305. How long are the tubes kept incubating?—Four days.

17,306. Have you ever tried to dilute the carbolized vaccine to see whether you could get any greater growth upon agar than you do by your present system of testing?—No.

17,307. Is there any precaution taken to see that the bottles or corks are sterilized? Is there any bacteriological test as to their sterility?—It has been done recently, I think, but I have no information of that.

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17,308. *Is* not it possible that although you might be decanting a sterilised fluid into the bottles, the bottles and corks might contain contaminations and therefore the fluid you send out might have bacteria in it?—Yes.

17,309. No precaution was taken against that as far as you know?—The bottles are sterilized.

17,310. But they are not tested?—No; at least they have not been till recently. I believe some testing has been carried out recently.

17,311. You say that you think that more than half per cent. of acid ought to be added to the disinfectant which is used for disinfecting the floors of houses?—Yes. Especially if lime has been mixed with the cow dung.

17,312. Have you tested the reaction of your floor after disinfection?—No.

17,313. Why do you think ammonia is given off from a cow dung floor?—The smell of ammonia is quite perceptible in a closed room.

17,314. (*Dr. Ruffer.*) I understand that the fluid was sterilized twice, once by carbolic and once by heat?—Yes, the carbolic is added after the heating.

(Witness withdrew.)

Dr. C. Balfour Stewart.

DR. C. BALFOUR STEWART called and examined.

17,315. (*The President.*) You have been employed in the Plague Research Laboratory?—Yes, since May.

17,316. (*Prof. Wright.*) You have been employed on testing the prophylactic?—Yes, I am responsible for it. I have done all the testing since the middle of May, except for the month of December, when I was away on leave.

17,317. Between May and December what tests were you applying?—The same as we do now. A small quantity was taken out of the flask with a sterilized pipette and inoculated on dry agar.

17,318. That is before the sterilization is undertaken?—Yes.

17,319. But is the testing of the vaccine after the sterilization process a new thing, or has it been done ever since last May?—It is comparatively new to test the bottles after sterilization and after decanting.

17,320. When was that system introduced?—I cannot say. I found it so when I came back.

17,321. When did you come back?—In the beginning of January.

17,322. When did you leave the laboratory?—The last day of November, I think.

17,323. This has been introduced between the end of November and the beginning of January?—I fancy so. I have not anything to do with that. I saw what was being done.

17,324. Your duties consisted chiefly in testing the purity of the broth culture before it was sterilized and converted into vaccine?—Yes.

17,325. Have you done anything else but that?—I have made several experiments with regard to the alkilinity of the broth, and I tried to find some other albuminous substance for the growth of the plague bacillus other than peptone.

17,326. I thought you had some evidence on the purity of the prophylactic, and the condition in which it was sent out?—I have done one or two small experiments to test the tendency of the prophylactic to become putrid from air organisms falling in. For instance, I have left a bottle of prophylactic open for a month, and taken cultivations at the intervals of two or three days with certain results. After it had been left open for 15 days or so I got a few colonies in the tube, and one or two days after that I got no cultivations at all. Again, I took another cultivation three days ago. After shaking the bottle, I took some from the top of the bottle which was fairly clear, and that remained quite sterile; but a cultivation taken from a lower part—from the sediment—gave about 30 colonies which had run together. The rest of the tube was covered with debris, but no growth.

17,327. Do you think living bacteria may be present in the sediment?—I think they may, but, at any rate, this prophylactic, which contains half per cent. of carbolic acid, is not a good medium for the growth of micro-organisms. A small flask of sterile broth put at the side of that bottle of prophylactic began to smell in three days, and it was thrown away. The prophylactic is perfectly sweet now, and there is no smell although it has been open for a month. After doing some inoculations at Tarrapur on the 18th of last month, I brought back the empty bottles. When I was at Tarrapur, immediately after doing some inoculations I poured the dregs of two or three bottles into one bottle and corked it up. I took inoculations from the dregs of that bottle which contained the dregs of two other bottles. That remained quite sterile, and I have inoculated the agar tubes at intervals from that bottle, which I call bottle A. On one occasion I got about 16 colonies, and on another occasion I got three or four colonies of a red bacillus. After that I got two or three tubes with no colonies at all. Probably this red bacillus was no longer present. There are no colonies on the last tube to-day.

17,328. These are isolated experiments; have you a methodical series of experiments or have you merely certain isolated experiments?—I have two or three isolated experiments with this prophylactic.

17,329. You have not entered into any systematic investigation of a number of samples?—No.

17,330. These experiments tend to show that the addition of half per cent. of carbolic renders the prophylactic a bad medium for the growth of bacteria? — Even after keeping some bottles I decanted the dregs of several bottles into one. The bottles had been lying about, and there was a quantity of dust on their necks, but I decanted all the dregs into another bottle and adopted the same process as before. I got a few large colonies and a large number of small colonies containing tetra-coccus. They did not increase in number: the last tubes I used did not show any more bacilli than the first tubes.

17,331. What experiments have you made with regard to the possibility of finding another culture medium?—I wish to find a substitute for peptone for nutrient broth, but nothing very much really came of it. It was necessary to find something which could be easily manipulated.

17,332. You have not succeeded in finding an effectual substitute?—I found the plague bacillus would grow very well in the alkaline albumen from white of egg, but eggs, I found afterwards, were inadmissible. I tried fish and cheese and glutine and pea flour, but all those things could not be manipulated very well. The solution would not filter clear in the slightly alkaline medium, and it only filtered clear at a too high degree of alkalinity for the growth of micro-organism.

17,333. M. Haffkine says in the letter before me, "I "beg to request the favour of your kindly obtaining "that the first two officers, Drs. Stewart and Gibson, "who have been called to give evidence before the "Indian Plague Commission, be questioned in detail "as to the above operations and their results," that refers to the operation of testing the vaccine?—Yes.

17,334. Testing the vaccine before sending it out?—Yes.

17,335. Have you any experiments which bear on the purity of the vaccine?—All my experiments have been in testing the purity of the vaccine after it has left the cultivation room.

17,336. Have you any experiments on the condition of the vaccine after it has undergone the sterilizing process?—I have not done any after sterilization.

17,337. I understood M. Haffkine referred to that?—No.

17,338. (*Mr. Cumine.*) You mention at the bottom of your précis an experiment of cultivating microbes from mud floors after disinfection with perchloride of mercury. Will you tell us what the result of that was? Did you make only one experiment?—Several small experiments were made. I scraped up some mud from the floor of a house which had been recently disinfected. In one case half an hour after disinfection the mud was damp still. In another case I scraped up some mud from the bottom of a pool of disinfectant after sweeping away the water, so that the disinfectant in that case had remained on the surface of the floor

ever since it was squirted. From all those I got a considerable growth of organisms and a good many cocci. Some of the bacilli were spore-forming, and it is quite possible they might not have been killed by the perchloride of mercury lotion, but there were numbers of micro-cocci present, which being without spores certainly ought to have been killed. I looked for plague bacilli, but the means at my disposal were not sufficient.

17,339. (*Prof. Wright.*) Did you disinfect those floors yourself?—I did not do it myself, but it was done under my observation.

17,340. Did you make up the disinfecting fluid?—No. It was made up with perchloride of mercury and a salt solution.

17,341. Do you know how it was made?—It was made according to the Government formula.

17,342. You did not yourself superintend the making up of the disinfecting fluid?—No.

17,343. Then you were testing the disinfecting powers of a disinfectant of unknown strength?—Yes. *Dr. C. Balfour Stewart.* 11 Feb. 1899.

17,344. And the deduction which you draw is that the disinfectant is not effectual?—Yes, with perchloride of mercury the pistons of the brass pumps which are used become perfectly mirrored with mercury, and the grease which is used for the pump is turned into a mercurial ointment practically.

17,345. You have not made experiments to see if you could disinfect satisfactorily with perchloride of mercury?—No.

17,346. (*Dr. Ruffer.*) How did you neutralize the perchloride of mercury when you made your cultivations?—I scraped up the mud from the bottom, and then inoculated some sterile water with them, and took the cultivations from them.

17,347. But that did contain a certain amount of perchloride of mercury?—Theoretically it would.

17,348. Did you take any steps to neutralize the perchloride of mercury?—No.

(Witness withdrew.)

(Adjourned till Monday next.)

At The Secretariat, Bombay.

FORTY-SIXTH DAY.

Monday, 13th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.
Mr. C. J. HALLIFAX (*Secretary*).

Assistant-Surgeon P. V. SHIKARE called, and examined. *Assist.-Surg P. V. Shikare.* 13 Feb. 1899.

17,349. (*The President.*) You are a Licentiate of Medicine and Surgery of the Bombay University?—Yes.

17,350. With what office have your duties in connexion with plague been associated?—I have been Medical Officer in charge of one of the segregation camps since October 1897.

17,351. Have you had the medical care of the patients in that camp?—Yes.

17,352. And have there been many patients under your charge?—There were no actual patients to be treated, because, as soon as a case developed symptoms of plague we sent it to hospital. There was general management, and such cases were to be detected as soon as they appeared in the camp. That was the chief object of a Medical Officer being there.

17,353. You have formed an opinion as to the predisposing conditions leading to plague?—Yes.

17,354. Would you express your opinion?—The predisposing conditions are those conditions that were pre-existing, and favoured the growth and spread of the infection. Thus, the subsoil of the town, including the floors of inhabited houses, was saturated with moisture and decomposing organic matter. Then there was general vitiation of the air on account of overcrowding. The climatic conditions of Bombay were also favourable for the growth of low organic life. Those, in my opinion, were the predisposing conditions.

17,355. What climatic conditions do you refer to?—The temperature and humidity of it.

17,356. Do you mean high or low temperature?—A temperature varying between 80° and 90°. That is suited for the growth of low organic life.

17,357. From where do you think the plague was introduced?—I think the plague was introduced from some of the epidemic areas outside India. I refer especially to the southern ports of China, such as Hong Kong.

17,358. You think it come from China; what is your reason for thinking so?—Because the place where plague was first observed was Mandvi. Now, Mandvi, in Bombay, is a place nearest to the docks, and it shows that the poison was imported by sea somehow or other; the only places outside India where the epidemic has been known in recent times, is the southern ports of China; and also, the town of Singapore, which was visited by plague in the spring of 1899.

17,359. You exclude Kumaun and Garhwal?—Yes.

17,360. Why?—I think that those places are only endemic areas for plague; no recent epidemic has been recorded in those places, because the latest dates of plague occurring in Kumaun and Garhwal are 1884 and 1886; 1884 for Kumaun and 1886 for Garhwal, and in my opinion, there is a far less chance of the disease being spread by places where it is endemic.

17,361. You exclude them because plague has not recently been present there. Have you any other reasons?—My other reasons are, because there is no direct communication between those places; they are not very important commercial towns; and if pilgrims were to travel from those places, they would take a long time to reach Bombay, as they generally travel on foot, and visit several other places on their way; so, if Bombay was infected, there was also a likelihood of several other places being infected before Bombay was infected, or along with it. But such was not the case, and, therefore, I do not

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think myself that plague was imported from endemic areas such as Kumaun and Garhwal.

17,362. Plague also visited Nasik?—Yes; but not during the first year while Bombay was affected.

17,363. How does that bear on your theory?—This way; the year 1895-6 was a sacred year, and thousands of pilgrims visited the sacred town of Nasik. If they come from all parts of India, there is a likelihood of their coming from these places also in Northern India, and of bringing the plague with them; but Nasik entirely escaped during the year, and so, I think Kumaun and Garhwal were not responsible for the plague of Bombay.

17,364. How do you think the poison has spread?—I think the poison is mainly in the soil, including the floors of houses which get mainly infected. The poison is existing there, and it probably grows in the soil, and from it it is taken into the system.

17,365. What are your reasons for supposing that the virus is in the soil?—I will read them:—Thus we know, from elements of bacteriology, that the lowest form of organic life (pathogenic or otherwise) thrive best in a medium tainted with putrefying organic matter having a certain amount of warmth and moisture in it, and removed from direct exposure to the sun's rays. Are not all these conditions fulfilled in the floors of inhabited dwellings generally, and those in overcrowded towns and cities in particular? The floor of an average native house will be found to have been made without any plinth, and therefore saturated with moisture derived both from the high subsoil water-level as well as from surface oozings. The moisture, again, is not aqua pura, but has in solution and suspension, besides inorganic substances, the products of decomposing materials derived from defective drains, where they do exist, or from a wholesale percolation of sewage water where the drains are absent.

17,366. What is your opinion as to the conveyance of plague by rats? Have you any facts bearing on that?—I have not got any facts to show. The only thing is that, as rats exist in soil and pass 20 hours out of the 24 in the soil, they are likely to be first infected; and this is observed to be the case everywhere.

17,367. What observed facts have you in regard to the incubation period; and what are your conclusions?—Of the cases of plague occurring in my camp, I have observed that the largest number was on the first day—that is, the day of admission—and nearly two-thirds of the entire number of cases developed within the first 48 hours of their stay in the camp, and this number of plague cases fell immensely in proportion to the number of days passed in camp; and there was no case observed amongst contacts beyond the 7th day. The total number of plague cases amongst contacts up to the 31st of December 1898 was 167. Of those, 52 developed symptoms on the day of admission, 35 developed symptoms on the first day, 20 on the second day, 21 on the third day, 12 on the fourth day, 14 on the fifth, seven on the sixth, one on the seventh, no case on the eighth, one case on the ninth, one on the tenth, and two after the tenth day. These three later cases—that is, those on the seventh, ninth, and tenth—were amongst re-contacts—that is, those persons who were in contact with plague cases developed in camp.

17,368. What is your conclusion with regard to the period of incubation?—I think, so far as my camp was concerned, it fell within seven days; and over two-thirds, most of the entire number of cases developed within 48 hours of admission.

17,369. How do you think the virus is introduced into the patient?—In bubonic cases, I think, the virus gets in by a process of inoculation. That is, it enters the system through some wound or abrasion or crack in the superficial structures in lymphatic connection with the particular set of glands affected. It enters the system through such wounds.

17,370. Why do you say that?—Because there is such a large per-centage of bubonic cases with buboes in the groin. I have already said that the poison is mainly in the soil; so of course, as a sequence to that, we expect a large number of cases with bubo in the groin, because the natives of India walk bare-footed, and they sit on uncovered floors.

17,371. You have had no distinct observation in which the virus has been introduced by lesions of the skin?—No.

17,372. Have you had much experience of pneumonic cases?—I have seen some, but I have not much experience with them.

17,373. Have you observed any pneumonic cases that seemed to have proceeded from bubonic cases?—No.

17,374. Have you observed any bubonic cases which seemed to have proceeded from pneumonic cases?—No.

17,375. Have you observed any pneumonic cases which seemed to have proceeded from other pneumonic cases?—No.

17,376. You have expressed the opinion that clothing may hold the virus, and thus communicate it to someone else; is that so?—Yes.

17,377. Have you any facts of your own which show that clothing, or anything but the person of a patient may convey plague?—No, no facts at all.

(Witness withdrew.)

Dr. A. Mayr.

Dr. A. MAYR called and examined.

17,378. (*The President.*) I think you hold medical qualifications from Germany?—From Austria.

17,379. Have you for some time been occupied in Bombay in assisting Professor Haffkine in plague matters?—Yes, since February last.

17,380. (*Prof. Wright.*) I believe you have something to tell us with regard to what you call the fermentation process that goes on during the manufacture of Mr. Haffkine's vaccine?—Yes. My duty has been to inoculate the fluid and prepare it. Dr. Stewart, in his evidence on Saturday, also touched upon this point.

17,381. Have you any new points? I do not know what you understand by the fermentation process; do you mean that you have examined chemically the changes which occur in the culture medium in which the plague-bacillus is grown?—No; it was a term which was suggested by Professor Haffkine. He meant certain trials about different culture media, about reaction of culture media, about influence of temperature.

17,382. Have you made some experiments in connection with the growth of plague in different culture media?—Yes.

17,383. Perhaps you would begin with the question of the reaction of the finid. Do you find that an alkaline reaction favours the growth of the plague?—The best reaction may be very slightly alkaline, it may even be neutral, especially if there is the growth for a long time in the liquid; whereas in agar and solid medium, a little more alkalinity may be of advantage; as it seems, that during the growth, alkali, and probably ammonia, is produced, which increases the alkalinity, and interferes with the further growth of the microbes.

17,384. Have you made experiments to determine whether the alkalinity of the culture medium increases *pari passu* with the growth of plague?—Yes. It happened by chance that several times our culture liquid got directly acid.

17,385. You mean that the culture medium was acid when it was inoculated with plague?—Before it was inoculated. As it is prepared with acid not sufficient alkali was added, especially as the ammonia sometimes gives decided reaction, before the final sterilization—after heating and sterilizing, the ammonia being evaporated, slightly acid reaction remained. That happened several times. I tried reaction with litmus paper to ascertain the reason why the microbes did not grow in the beginning. I found it was slightly acid reaction. In certain cases I added a small quantity of alkali and then the growth began. In other cases I left the liquid without adding alkali, and, perhaps, after two or three weeks, a growth began to show itself; and if the reaction was tried after that, it was found to be alkaline—not very strong, but still decidedly alkaline.

17,386. Did you find that that alkaline reaction was due to the presence of ammonia?—Partly, no doubt; because, in trying the reaction with red litmus paper, it turned blue, but after being dry the blue colour disappeared almost entirely, showing thus that the

alkaline reaction was chiefly due to volatile alkali (ammonia). Further chemical investigations were not possible, as there there were no means for them.

17,387. Have you made any observations upon different culture media?—Yes. I have tried sugar, gelatine, and glycerine to the common culture media, but no advantage was to be found, especially with sugar. Sugar seems rather to interfere with the growing. No doubt the microbe grows best in soluble albuminous matter. It grows in albumose better than in real peptone; at least it shows a quicker growth—as our present culture liquid contains almost all albumose, and very little peptone.

17,388. Have you made any observation upon the accidental contaminations of the prophylactic fluid?—Yes; but Dr. Stewart referred to that matter.

17,389. Dr. Stewart told us that he had made no examination of the fluid after it had been finally sterilized?—We inoculated last year 1,200 flasks.

17,390. These experiments bear upon the fact of the occurrence of contamination before the prophylactic is sterilized?—Between inoculation with plague-germs and final sterilization.

17,391. These experiments do not bear, do they, upon the possible contaminated condition of the prophylactic as it is sent out?—No; after the inoculation with plague-germs.

17,392. That is one of the intermediate stages of manufacture?—Yes.

17,393. Have you any observations on the fluid as it is actually sent out—observations, I mean, which bear on its sterility or otherwise?—I made certain investigations lately, and there is no doubt that in certain cases a scanty growth, especially in very old bottles which are badly corked, may be found. I am making experiments on the subject at the present time.

17,394. You have no experiments you propose to put in?—No.

17,395. You have only made a few examinations?—I made a few examinations for myself, because I thought the original sterilization of the bottles might not be always sufficient. I made certain experiments, but I have no idea of giving evidence with regard to them, because they are not conclusive enough.

17,396. Is it your opinion that sterilization at 65° C. for an hour is always effectual?—Yes, as regards plague microbes.

17,397. But not with regard to others?—That refers to the original sterilization of the empty bottles in which the liquid is afterwards decanted. When the flask with the culture is heated to 66° C., there are no other microbes in it than plague microbes. All other flasks are rejected.

17,398. Have you made any experiments with Lustig's serum?—Yes; I had the opportunity, when Dr. Galeotti came here, of going to the hospital where he injected; and I observed a few cases which seemed to me of very great interest, and, perhaps, of more value than statistics.

17,399. Was the serum that you saw injected, serum that had been manufactured in Italy?—Yes, it was serum from Italy.

17,400. How many cases did you see injected with this serum?—I saw many cases. I used to go to the hospital. There were only two cases in the very beginning in which bacilli were found in the blood by microscopic examination and by the culture method. After the injection of this serum—two injections in every case—the microbes disappeared, and the patient recovered in a very short time after three injections.

17,401. Do the microbes ever disappear from the blood in cases where serum has not been given?—Such cases are supposed always to end fatally, at least, all the observers say so.

17,402. Have you yourself made any observations upon this point?—I know that Dr. Bitter states that when the blood is infected with microbes no recovery has ever been noticed. The Austrian and German Commissions stated the same. It may be that somebody else may have observed cases where plague microbes have disappeared by themselves, but I could not say anything about it. I only know that there were three cases, two of which I saw myself. I was present at the examination where the plague microbe disappeared and the patient recovered.

17,403. You speak, in your précis, of nervous symptoms improving after the injection of serum?—Yes. This is really a very common symptom, and goes sometimes together with the lowering of the temperature, sometimes it is entirely unconnected with it.

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17,404. (*Dr. Ruffer.*) I wish to ask you some details with regard to the few cases in which you said that the microbes disappeared after the injection of Lustig's serum; how long had these cases been ill when you first examined the blood?—The first, on the 11th of April, was the case of a sepoy from a regiment here. He was a very strong man, a Hindu, 20 years old. He was sick one day, and brought to hospital. There was continuous vomiting and diarrhœa from the beginning. He was very delirious and agitated when brought to the hospital. He had, as is usual, to be tied down, and have a special attendant. His temperature was 104½ and pulsations 128. He had a small tumour of the spleen, and a small bubo in the right groin. The symptoms were rather alarming.

17,405. Did you make an examination of the blood?—Yes. After sterilization of the finger, a drop was taken, and coloured in the usual way. Several agar tubes were made before inoculation, and at the microscopic examination microbes, looking like plague microbes, were detected. After two days, the agar tube showed an abundant growth of pure culture of microbes, which were afterwards inoculated into the peritoneal cavity of white mice, and produced death, in one case in 26 hours, and in the other case in 24 hours. The man was injected in the morning with 20 c.c. of serum. I may state that it was the most active serum which has been brought out. The temperature went down to 102, but as the delirium did not change, he was again injected with 15 c.c. in the afternoon. On the morning of the next day he was much better. He only vomited twice during the day, the delirium had nearly passed away, and he looked quite free. In the afternoon he was inoculated a third time. Before the third inoculation another examination of the blood was made in the same way, with coloured preparations and with cultures, but no bacilli could be found. The man recovered very soon. On the 13th April—on the third day of his sickness—he was so well that he did not require a further injection. He was perfectly conscious and had no vomiting or diarrhœa. The small bubo, which was very painful in the beginning, disappeared after five or six days, and the man himself was discharged as cured after 12 days. The second case is that of a ward-boy at the Arthur Road Hospital, a very strong man about 20 years of age. He got sick during the night of the 15th of April (four days after the other man was brought there) with shivering; and then the temperature began to rise. As it was thought that he had got plague he was at once taken to the hospital, and in the morning he was shown to us. His temperature was about 100° and he had a small bubo in the right armpit. He was not thoroughly unconscious, by that I mean to say he was not delirious. He was in a kind of stupor. He did not answer any questions. An examination of the blood was made on the same day. The whole preparation was full of microbes, which looked like plague microbes. Four agar tubes were taken, and the characteristic colonies appeared. White mice were inoculated, with a similar result to that of the first case. This patient was injected for the first time at 10 o'clock in the morning with 20 c.c. In the afternoon he was somewhat better, but as no special amelioration could be noted he was again injected with 15 c.c. The following morning he was much better. His temperature went down to 90°—it was never very high. His pulse, which was rather high—130—went down to 92. His respiration, too, at first seemed to point to some complication in the lungs. A second examination of the blood was made, and no microbes could be found. The same remark applies to the agar tube. The man had a third injection of 10 c.c., and he, also, recovered very quickly without any interference. He was discharged 11 days afterwards. There was another case, but I had not the opportunity of seeing it myself. That other case ended in recovery, notwithstanding the fact that plague microbes were found in the blood. In all three cases the injections were made at the very first moment and the patients recovered very soon.

17,406. In how many cases have you examined the blood for plague microbes—not including these two cases?—Only two. I was not really employed in the hospital. I was present, but I did not make the preparations myself, as I had no microscope at the Arthur Road Hospital.

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17,407. Have you examined urine for plague microbes?—I have not done so myself, but I know the case of a private patient of Dr. Galeotti where plague microbes were found in the culture. That case eventually recovered after a long period.

17,408. Have you ever examined the fæces?—Yes. A short time ago I saw a case where there was extensive bleeding from the bowels, but no microbes were found. I got a cultivation, but I could not find any plague microbes.

17,409. Have you ever examined the fæces of rats?—In a few cases, but I did not make any real methodical experiments.

17,410. Have you ever found plague microbes in the fæces of rats?—No. I only made experiments in a very few cases. But I found plague microbes once in the urine of a rat, but in that case I had not the opportunity of making more experiments.

17,411. What animals do you think are more susceptible to the inoculation of plague, mice or rats?—I think mice.

17,412. In what way—what kind of inoculation?—In the peritoneum. We used to do that when we wanted to be sure—to kill the animal when we were not sure about the virulence.

17,413. Is that better than sub-cutaneous injection?—No doubt it is. It is quicker and more sure.

17,414. Have you any facts to show that rats can take inoculation through the mucous membrane of the nose?—I have made no experiments with regard to that.

17,415. Have you any experiments to show that sub-dural inoculation will produce plague?—No: but I have no doubt about it.

17,416. Nor have I; but I want to know if you have any facts about it?—No, I have not.

17,417. (*Prof. Wright.*) Do you, in connection with the preparation of the prophylactic, inoculate the flasks with plague?—Yes.

17,418. How do you get your plague cultures: do you employ a series of different plague cultures?—When there were more plague cases in Bombay, we used to get every second or third time fresh microbes from patients in the Arthur Road Hospital, from the buboes or the sputum, and carry them on agar, or peptone solution, and inoculate that. Later on, in April and May, it was difficult to get them because we had no patients. We had not, at that time, the opportunity of carrying microbes through rats, and so on, because there were very few hands there, and we had not the means of doing it. We were obliged to carry the microbe from one peptone solution to another. Once we got fresh microbes from Hubli, and at another time from Bangalore. About every month we tried to get the fresh virus. Now, we have more time, and we are not so short-handed. We are beginning to get our cultures by inoculating rats every time, and we take the microbes from the rats.

14,419. Was it your practice to test the virulence of the microbe you used?—No, the virulence was not usually tested. At that time we had no time or possibility of testing the virulence by making the injection in animals.

17,420. Do you think that sometimes you may have used very virulent plague, and at other times a non-virulent plague?—Yes, no doubt; because I remember that, when the Russian doctor was working at the laboratory, I had the opportunity of getting from him virulent microbes, as he was making extensive experiments in connexion with inoculation. He usually had a stock of virulent microbes, so I got them from him. At other times, we had this microbe and another microbe carried through one month from one flask to the other, never passing an animal, so, no doubt, in such cases the virulence was diminished.

17,421. Do you know what brews were made with virulent microbes, and what brews were made with non-virulent microbes; have you records with regard to that?—Yes. That means to say, I know such source was used for such a number of flasks. Others are, I believe, more virulent. The first set, before it was brought in a second peptone solution, ought, no doubt, to be more virulent than the later ones, which were taken, perhaps, in the tenth generation from this one.

17,422. Have you any facts to show that vaccine was more efficacious when you used virulent microbes than when you used non-virulent microbes?—I had not anything to do with the inoculation of the prophylactic itself. It seems that from outside it was stated that in some cases less fever was produced. I do not know that the fever has any very real bearing upon the immunity. That is a question of itself. I have no experience about this.

17,423. Latterly, I believe, you have been making passages through rats to increase the virulence of the microbes?—Yes.

17,424. Have you found, so far, the virulence increases by making passages through rats?—No conclusive experiments have been made till now to ascertain the increase of virulence or otherwise by passages through rats, but such experiments are being commenced. One rat which I, inoculated has not died up to date. This is the third day. I made the injection on Friday, but the rat did not die, probably because our microbe was not virulent enough. I wanted the microbe which was used for our inoculation to pass it through the rat, and to get the increase of virulence; but it was not virulent at all. I took one-fourth of the culture in the test-tube, and it did not kill it. I have tried to get another microbe from the hospital. (Note added by witness on correcting proof of evidence:—The rat died the day after I gave evidence. From a culture made on agar from its heart's blood another rat was inoculated with a loop-full, and died after three days. The virulence must, therefore, have been increased in this instance.)

17,425. At the present you are making vaccine with plague microbe which is not virulent enough to kill rats in three days when you inoculate one-fourth of a tubeful?—That is so. It was, however, only one experiment. It may be that the second experiment may prove successful.

17,426. Is this the first time you have begun to increase, or to try to increase, the virulence by passages through rats; have you any previous experiments to show whether the virulence can be increased by such a series of passages?—I was helping and working with Dr. Galeotti and Dr. Vigoura, who had continually to pass their microbes through rats or monkeys to make them more virulent. I remember that Dr. Vigoura got an original microbe from us, which was not virulent sufficient to kill monkeys in three days, and it was passed twice through white mice, and then rats, and two monkeys, until the required virulence was obtained, so that the monkey died within 42 hours; whereas in the commencement there was no possibility of killing a monkey with the same microbe in such short time.

17,427. Then you do not agree with Dr. Yersin, who says that the virulence decreases in passing it through rats?—No; at least, from what I saw, we never had that experience. We always found quite a marked increase by passing it through rats and mice.

17,428. Have you seen enough to make you feel sure that the virulence of a plague culture increases when you make a series of passages through rats?—I never saw it passing through a series of rats.

17,429. How many generation of rats do you think the culture was passed through?—The one I have in my mind just now was passed through two white mice, then a rat, and then two monkeys. Then it was of the required virulence to make the culture for the serum preparation.

17,430. You have not seen a culture pass through three or four generations of rats?—No; we did not do that, because we did not want any more than that. It may be that after several generations of rats it may decrease. I will make experiments with regard to that later on.

17,431. (*Dr. Ruffer.*) Have you tried the effects of Haffkine's prophylactic fluid on animals?—Not myself; but it was made in our laboratory, and I know about it. Experiments were made on monkeys, especially with the deposit of the liquid, as it was supposed that immunity might be conferred by the deposit.

17,432. Has it an immunising effect upon animals?—I do not say it saves from a very virulent microbe; but there is no doubt the resistance is very much increased. The control animal always died, whereas the immunised sometimes survives. Whenever the immunised monkeys died, they always died much later than the other one.

17,433. Have you made any experiments yourself?—No.

17,434. Who made the experiments?—The Russian doctor who was working in Professor Haffkine's laboratory. When he was working there I saw him do it.

17,435. You are not responsible for these experiments?—No.

17,436. (*The President.* Have you any method by which you could exactly define the toxic activity of any virus you have grown?—Yes; it is to be done by inoculating a filter culture. Experiments have been made which I know of (though not performed by myself) which show that strong toxic effects are produced by filtered cultures.

17,437. I mean with the virus containing the living bacilli?—I should not say otherwise than by trying the amount which is required to kill a rat or a white mouse, as is usually done. I did not notice any difference in the growth in different media. It may be that very virulent microbes grow a little slower than the less virulent ones.

17,438. Did you adopt any process for determining exactly the virulence of any virus; have you any method you are in the habit of using?—Yes. The usual way is to have a certain culture. You take a certain amount, a loop-full, and dilute it with a certain amount of water or broth, and then inoculate a given amount. You compare as much as you want from it. If you have a microbe that kills with a quarter of a test-tube, it is supposed to be more virulent than a microbe which kills with an injection of half a test-tube.

17,439. In the case of any virus which you have examined, can you tell us what is the smallest amount that will produce death in any given animal?—I should say with what we call a platinum loop-full—even with less virulent microbes—a rat dies.

17,440. Have you made experiments with the filtrate?—Not myself; but I saw the experiments made. *Dr. A. Mayr.*

17,441. You know the result of the experiment with the filtrate; you have observed the experiments?—Yes. 13 Feb. 1899.

17,442. On what animals were the experiments made?—White mice.

17,443. On mice only?—Yes.'

17,444. What is the smallest quantity of this filtrate to a given weight of animal which is capable of producing death?—I could not tell from memory. I think it is a very small quantity; about 1 c.c.—and less if the filtrate is derived from a virulent culture—killed a white mouse in 48 hours.

17,445. I understand you determine the lethality only with the liquid filtrate?—Yes.

17,446. Have you ever passed the virus through mice?—Yes.

17,447. Have you seen any cases in which the virus became attenuated, or weaker, after being passed through animals?—No, I did not notice such a thing.

17,448. Do you know if such experiments have been made in Bombay with regard to the plague bacillus or virus?—Not to my knowledge. Dr. Gibson has made many experiments with regard to rats; but I do not know anything about them.

17,449. Do you know if any experiments have been made by introducing the virus into the alimentary canal?—No, I do not—only by way of feeding. I believe it has been done here by Dr. Gibson, but he has had no positive results that I know of. I believe it has been done by several other observers.

(Witness withdrew.)

Captain C. J. R. Milne, I.M.S., called and examined. *Capt. C. J. R. Milne, I.M.S.*

17,450. (*The President.*) I understand you are conducting investigations in the laboratory here in connection with plague?—Yes, in M. Haffkine's laboratory.

17,451. (*Dr. Ruffer.*) Would you read to us your rules for sterilising the culture flasks?—They are as follows:—

"1. All cultivation flasks ready to be sterilised are placed by the testing officer in the inoculation room on a special table designed for that purpose, and having a label pasted upon it, "Flasks ready for sterilisation."

"2. The flasks are to be transferred into the sterilisation room by the sterilising officer himself, or by his assistant under his immediate supervision.

"3. Only the precise number of flasks ready to be put immediately into the sterilisation tub should be removed from the inoculation room. Any flask which cannot be put into the sterilization tub immediately should be replaced into the incubation room. On no account should unsterilised cultivation flasks be allowed to remain in any part of the laboratory except the incubation room.

"4. A label to be made out for each flask, stating its number, the quantity of prophylactic it contains, and adding the word 'heated.' The date of heating, however, must not be entered on the label till the flask is removed from the hot-water bath and from the cooling tub.

"5. The sterilising officer further puts his initials in red ink on the original label affixed to the flask.

"6. Place the new labels on the plug of the flask and fix the paper cover on the mouth.

"7. Put the cultivation flasks, together with the 'control' flask, into the water bath, and mark in the special note book kept for the purpose the time when the thermometer in the 'control' flask shows 65° C. Leave the flask in the tub for one hour counting from that moment.

"8. On the expiration of the hour remove from the bath and cool.

"9. The original label of the flask to be examined, and to ascertain that it got either detached in the hot-water tub, or that the red ink of the initials shows the effect of the hot water. The new labels to be now removed from where they have been resting on the plugs, the date of heating marked on them, and the labels themselves pasted on the sterilised flasks.

"10. Note the quantity of prophylactic in c.c. in each flask, and add carbolic acid in the proportion of one-half per cent."

17,452. How do you measure the quantity in each flask?—Originally, before the flasks are inoculated, the amount of c.c. is placed on each flask, generally 1,200 or 1,500 c.c. That remains on the flask till it comes to the sterilising officer, who makes a note on his new label of the amount. The rule goes on: "The total quantity "of carbolic acid added to each flask to be marked on "the label."

"11. Mark the fact of carbolising, and the date on which this was done, on the label.

"12. In the book kept for the purpose, enter the date of heating and carbolising against the numbers of the flasks heated and carbolised in the respective columns, and state the actual amount of pure carbolic acid added.

"13. Flasks are now ready for decanting, and should be placed in the special cupboard for the decanting officers."

17,453. How do you add the carbolic acid?—A bottle of carbolic acid is sterilised and sterile pipettes are taken on which the quantity is marked in c.c.

17,454. What strength of carbolic acid do you use?—Pure carbolic acid: the ordinary carbolic acid that we get from the medical stores here, and we sterilise that and use it.

17,455. How long have those rules been applied?—The rules were actually in existence when I came to the laboratory, but the modification in the amount of carbolic acid added took place about four months ago; we used formerly to use one quarter per cent.

17,456. What are your rules for decanting and testing the fluid after sterilisation?—They are as follows:—

"1. The decanting officers to take the flasks from the cupboard where the flasks that have been heated and carbolised are kept.

"2. Examine closely the label, and do not proceed to decant till you learn from it (*a*) the fact of its having been heated and carbolised, (*b*) and the date on which these processes were done.

"3. Having satisfied yourself of this, put your initials on the label.

"4. Provide yourself with the necessary apparatus for decanting, a stand, a pair of forceps, a clip, sterilised bottles, a sterilised syphon, and sterile agar tubes."

17,457. How do you sterilise the bottles?—The bottles are sterilised in a large steriliser; they are first carefully cleaned, and corked, and we have pieces of

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paper tied over the corks, and then they are sterilised in bulk. We generally sterilise about 1,000 at a time.

17,458. Are they sterilised with the cork in the bottle?—Yes.

17,459. By steam?—Yes.

17,460. At what temperature?—I am not positive as to the temperature; I have not charge of that department.

17,461. Please continue the rules?—"5. Heat carefully the neck of the flask to be decanted as far as it can be done without cracking the glass, and passing the flame of the burner at the same time over the surface of the plug.

"6. Fix the flask on the stand.

"7. Sterilise the glass of the syphon to be introduced into the flask by passing it several times through the flame of a Bunsen burner."

17,462. How long is that glass that has been introduced into the flask?—There are two parts. There is a long part which is put into the flask, which is about 12 to 14 inches long, and then there is a piece at the end about three or four inches long. There is only a piece of rubber tubing between the part inserted into the flask and the glass tubing at the end of the syphon, and on this rubber the clip is placed.

17,463. How do you sterilise the whole of it?—The syphons are generally sterilised at the same time as the bottle.

17,464. I suppose you plug the syphons?—Yes: "Next having sterilised in the same way the ends of the forceps, seize the plug at the mouth of the flask with the latter, and remove it partially, and introduce the syphon, finally pushing back the plug in place."

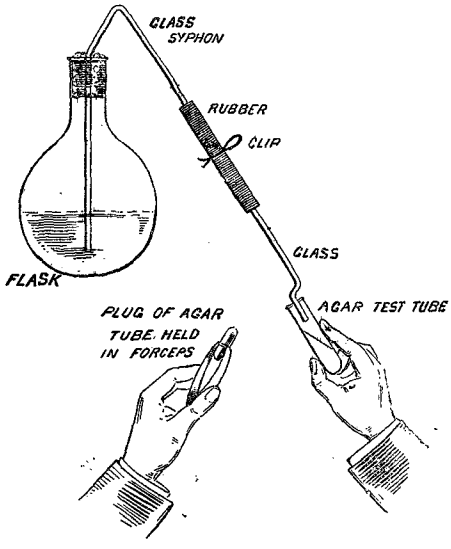
17,465. How do you fix the syphon into the flask—with an india-rubber cork?—No; we remove the cotton wool block, and insert the syphon into the flask by the edge of the cotton wool block.

"8. Fasten the clip in position on the syphon.

"9. Immediately before sucking shake the fluid with its contents well round.

"10. A suction tube (short rubber tube provided with a glass mouthpiece) is next fitted on to the end of the syphon hanging out of the flask, and the prophylactic is then sucked out from the latter down to the level of the prophylactic in the flask."

17,466. How is that done; how is it sucked out? (The witness produced the following rough sketch and explained the same to the Commissioners.) Will you



please proceed with the rules?—Yes; "a current having been thus established, the suction tube is removed and the end of the syphon sterilised with the burner.

"11. Before decanting the fluid into bottles, take a sterile agar tube and fix it between the thumb and forefinger of the left hand, remove the plug with the forceps and place it between the fore middle fingers of the left hand, heating gently the mouth of the tube. Sterilise the end of the syphon and allow some fluid to run through it, then carefully insert the end of the syphon into the agar tube and allow one drop of the fluid to fall on the top of the surface of the agar slant. Then remove the syphon end, and sterilising the mouth of the tube and the cotton plug, re-insert the latter in the former with the sterile forceps. Then write on the label of the tube the number of the flask, the date and your initials.

"12. The liquid is then decanted into the bottles, care being taken—

1st. To shake the flask between every bottle filled.
2nd. To see that the bottles used are all clean and free from cracks.
3rd. That the corks are well fitting.
4th. That the end of the syphon, the mouths of the bottles, and the corks are kept sterile, this being done by repeatedly using the burner.

"13. After decanting, the number, capacity of, and the number of bottles filled from each flask are entered in the book kept for the purpose, and the decanting officer's signature affixed against it. A specimen label for the bottles filled, showing the number of the flask and the date of decanting, to be also made and handed over, with the bottles, to the sepoy who seals them.

"14. After the day's work is over all emptied cultivation flasks to be shown to Dr. Milne, who will affix his initials on the labels.

"15. The flasks are then to be placed in the go-downs in charge of the go-down clerk."

17,467. How long have the rules been in existence?—The rules have always been in existence, but the modification of testing the decanted fluid on agar has been in force since the 12th December.

17,468. Were you in charge of the Department before that?—Not actually in charge of it; only assisting Professor Haffkine.

17,469. You do not know what was done before that?—Yes, I have been nine months in the laboratory.

17,470. What was done in the first instance?—We never tested the fluid before—after its sterilisation and carbolisation—but the other processes are exactly the same.

17,471. Since when have you taken to testing the fluid?—Since the 12th December.

17,472. You do not test the fluid after syphoning into bottles?—Not unless the syphoner's tubes show impurities; in that case I test the fluid in the bottles.

17,473. Could you show me how you put the cork in, and how you seal it in a bottle like *that*? Do you turn it after the cork is in and dip it in the sealing wax like *that* (illustrating with one of the bottles produced by Witness)?—Yes.

17,474. How do you shave off the top of the cork?—We do not shave off the tops of the corks at all. The cork is pushed right into the neck of the bottle.

17,475. Have you made any experiments as to the proportion of tubes that were contaminated?—I have first to explain, that in the beginning of November there was a very great demand on our prophylactic, and we had to increase our staff greatly, and we could not get Hospital Assistants and the class of people we wanted as decanters, and we had to engage clerks, and they had to be taught how to syphon properly. In the early days of the testing of the material with these tubes by the new syphoning officers, more than 50 per cent. were found to be contaminated, although the material itself was actually pure. Out of a series of 79, 36 showed sterile tubes, while 43 showed impurities which, however, at re-examination proved to be due to the defective testing by the syphoning officers, the material itself being sterile. Latterly, the proportion has become less than 1 in 20. An experiment was made on December 28th, 1898, as follows. While syphoning seven flasks, the syphoning officers were ordered to inoculate three agar tubes, thus:—

I. The first at commencement.
II. The second after syphoning into 10 bottles.
III. The third before syphoning into the last bottle.

The result is as follows: All three tubes of the first flask were contaminated; in the second flask the first

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and second tubes were sterile, and the third contaminated; in the third the first and second were contaminated, and the third sterile. In the fourth and the fifth, the first was contaminated and the second and third were sterile. The sixth was like the third; the third tube was sterile, and the first and second were contaminated. In the seventh the first tube was sterile, and the second and third contaminated. Eleven of the contaminated tubes showed less than three colonies, two showed extensive growth, while eight were sterile; that is one at least from each flask. The fact that from the same flask sterile and contaminated tubes were forthcoming, pointed conclusively to faulty manipulation on the part of the syphoning officers. When the decanter's tubes showed contamination of any sort, either single or multiple colonies, bottles of the series were examined, and in no instance was a bottle found contaminated. We have examined altogether 985 series since the 12th December, and all of these have proved sterile; and there are 48 series of which the bottles are being tested, the agar tubes not being yet ready for examination.

17,476. How do you test the bottles?—The method of examination was as follows: The sealing wax having been carefully melted, the cork was prised out with a sterile forceps. A sterile pipette was introduced into the fluid, the bottle having been shaken, and a small quantity of the fluid was sucked up and successively transferred to two agar slants and to a sterile flask of broth. The bottles were then re-corked and re-sealed

17,477. How much was removed?—As far as I could judge I used to take about a c.c. I made a mark on the pipette.

17,478. You say you put it into sterile broth; how much broth did you use?—I think 50 c.c. of broth. I am not absolutely positive. The bottles were then re-corked and re-sealed, and the bottle with its flask of broth and its two agar tubes, and in many instances a slide of the deposit were arranged in a dark room at the ordinary temperature, and were examined after four days to 21 days.

17,479. That would account for aërobic microbes, but could you detect an anaërobic microbe?—No. I wish to submit samples of recent syphoners' tubes showing series marked "fit" since February 2nd, 1899, and also showing the contaminated tubes in the same period. These (handing a number of syphoners' tubes) are samples of syphoners' tubes which have been marked "sterile," and *here* are some impure ones. The material in the bottles, on being tested in these instances, was found to be pure.

17,480. Have you examined any old bottles of prophylactic?—Yes.

17,481. Can you give us your experience as to that?—Bottles from 125 series have been examined by myself with the assistance of Drs. Gibson and Ransome. Those series have been stored in the laboratory for a variety of reasons, such as the weakness of the brew, &c. One dates from May 1897, while two date from March 1898. The others form a continuous series of those prepared in the laboratory from August to the middle of December 1898. The bottles of each series have been kept stored in boxes or in cupboards in the dark. Of these 125, in 104 series the sealing of the bottles was satisfactory, while in 21 it was broken or had holes in it allowing the cork to be exposed to air and dust. I have stated the method of examination. The bottles are all in the laboratory now with their flasks and tubes, and they are on view. The whole of them were examined finally by Professor Haffkine and myself. In the examination of the results, where in two instances only one of the two agar tubes showed a single colony, while the broth cultivation remained sterile—this was considered accidental, and as having occurred during manipulation, but if the broth was also contaminated, although the two agar tubes showed only one colony, the bottle was marked "contaminated" and the series re-tested. In about half-a-dozen instances the broth alone has shown growth while the agar tubes remained sterile. Professor Haffkine thinks the manipulation of the sterile pipette from the two agar slants to the broth is quite liable to allow of its being contaminated during the interval. He thought afterwards we ought to have used a fresh pipette; that I ought to have inoculated the broth with a fresh pipette separately from the agar tube. In the first instance, of the 104 bottles with satisfactory sealing, 98 were found pure, and six contaminated. Of the 21 series, in which the bottles had broken sealing, one was found to be pure and the remainder contaminated. Of the six contaminated bottles where the sealing was good, in all six broth and agars were affected. Three of these were contaminated with moulds only. One had several single colonies, while in one the surface of the tubes was covered with colonies. Of these six series it has only been possible to re-examine up to date two duplicate samples, and both these have been found sterile. Of the 20 contaminated and badly sealed series, in 18 both broth and agars were effected; in two series the broth remained pure. In 14 of them the agars were covered with mixed growth, while six showed a few isolated colonies. 10 well-sealed duplicate samples of these 20 contaminated series were re-examined, with the result that eight were found to be pure and two contaminated, while in three series satisfactory samples could not be found, and all three again with unsatisfactory sealing were found to be contaminated. Of one series still a third bottle was examined with a similar result. Of the two contaminated ones from the well-sealed series, one has been re-tested for a third time and found pure. The conclusion seems to point emphatically to the contamination of bottles taking place after the material has been bottled and sealed up and being due to defective sealing. This has been taken into account for some time, and experiments are being made to substitute a more effective method of corking and sealing the bottles.

17,482. Would you show us why you think the method of sealing is unsatisfactory?—(The witness explained same to the Commissioner.) Apart from the defects in the sealing, there is also the fact that the cork gets sodden in contact with the carbolised fluid. There are thousands of them stored in the laboratory, and the corks get sodden in time, and the appearance of the sealing wax entirely changes; it gets this open appearance, not as it is at first. *Those* are newly-sealed bottles. I have a bottle here which was perfectly sealed, but it leaked between the sealing wax and the neck of the bottle, and this would account for the contamination of the number of bottles where the sealing wax was apparently intact.

17,483. Have you any other facts to tell us?—No, I have not, except that we hope to institute rubber corks for the bottles. At present we are making experiments—Dr. Stewart and I are doing them—as to soaking the corks in boiling paraffin, and then fixing them in and sealing them over.

17,484. Have you any evidence about anything else that you wish to bring forward?—No.

17,485. With regard to inoculations, I believe you have done a good many?—Yes; I have done over 800 altogether.

17,486. Have you ever seen any abscesses?—No, never.

17,487. Have you seen any severe results following the inoculation?—Never.

17,488. How many of these patients have you seen twice?—I took a series of 200 people in the jail, who were inoculated by Professor Haffkine and myself, and I examined them 7 hours after inoculation, 24 hours, and 48 hours. I took their temperatures and examined them thoroughly.

17,489. Were they all inoculated with the same brew of fluid?—They were inoculated with two different brews made at the same time.

17,490. Did you find that the same brew of fluid produced the same rise of temperature in all the patients?—No, it varied with the patient.

17,491. How much did it vary?—The lowest temperature I recorded was 99, and the highest temperature was 104·6.

17,492. What were the temperatures between these two limits; was there an average temperature?—Yes. The average of the maximum temperatures, for the three times that I took the temperatures, was 101. The average temperature for the whole lot of observations was just over 100.

17,493. We had it in evidence that a temperature of 102 is the ideal temperature?—Yes.

17,494. In these cases you did not get that?—I probably did not get every man at the time when his maximum temperature occurred.

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17,495. We have been told that one of the principles of inoculation was that you should produce a temperature of 102, but if you get a difference of between 99 and 104, how can the rise of temperature be used as a standard?—In most instances we have not been able to follow out the case completely. I inoculated my servant and had him completely under observation after he was inoculated; and I took his temperature every half hour. His temperature reached 102·3; that was the maximum about eight hours after inoculation.

17,496. But supposing you take 100 cases, as you have done in the jail, and the temperatures vary from 99 to 104, how can the temperature be the standard of efficient immunisation?—My experience of the work is insufficient to allow of my judging this question accurately.

17,497. And you have no special observations bearing on that point?—No.

17,498. Have you any facts as to animals getting the disease from one another?—I generally look after the animals kept in the laboratory for experimental purposes. Within the last few weeks a number of rats, under the orders of the Municipal Commissioners, have been brought into it. Living rats and dying rats, and all sorts of rats, and I have noticed that several of the original rats in our laboratory, which were kept in cages alongside of the others, have died of plague. They must have been infected from the other rats which had been brought in. Latterly, all rats which have looked at all ill, in fact every rat brought from Bombay, has been kept in a special cage and room. Most of them have succumbed to plague within a day or so.

17,499. Do you find plague microbes in their blood after death?—If they are examined fresh, I do—heaps of them.

17,500. Does the microbe disappear very quickly?—Very quickly.

17,501. In how many hours?—One has great difficulty in getting it after 10 or 12 hours.

17,502. Does it depend on the temperature or any other condition?—I am not aware of any special conditions.

17,503. Have you examined the urine and fæces of patients for plague bacilli?—No, I have not. I have examined the urine of rats.

17,504. Have you found it there?—No; I have only examined in five cases.

17,505. How did you examine it?—In nearly all the rats which have died of plague, which I have examined, I have found the bladder full of urine. I introduced a sterile pipette and sucked up the urine and made cultures from it, but I have never found any plague bacilli, nor has Dr. Gibson, I think. Dr. Gibson and I have been working together a good deal at this.

17,506. How long have the rats been dead?—They were only just dead.

17,507. There is no doubt about their having died of plague?—Absolutely none.

17,508. Can you tell me whether you have made any experiments as to the prophylactic effect of Haffkine's fluid on animals?—No. I have started an experiment with regard to rats, but I have not yet completed it.

17,509. Have you ever injected the prophylactic fluid into animals?—Only into rats in the experiment on which I am working at present.

17,510. How much did you inject?—I injected into one rat the dose marked on the bottle.

17,511. How much is that?—It happened to be 2½ c.c.

17,512. What effects did it produce upon that rat?—The rat is still living.

17,513. Have you used the same prophylactic fluid on man?—No, not yet. I am working at that just now.

17,514. You do not know whether the rat has been protected or not?—No, that is a point I want to work out.

17,515. (*Prof. Wright.*) I understand it is the first portion which is drawn off from each flask of carbolised vaccine which you test?—Yes.

17,516. In view of the fact which Dr. Stewart told us yesterday, that contaminating bacteria cannot multiply when they are introduced into this carbolised vaccine, do you think that you have a satisfactory test of the sterility of your vaccine when you test it by introducing your undiluted carbolised vaccine on the surface of an agar tube?—I do not think it is myself.

17,517. Have you met with any bottles of M. Haffkine's prophylactic which have become putrid?—Two of the original series which had not been carbolised, were badly smelling, but on testing them on agar and in broth in the series mentioned, they were found sterile.

17,518. When was the method of adding carbolic to the vaccine introduced: I thought an addition of carbolic had always been made to the vaccine?—I do not think it was in the case of the very early ones. I have a bottle dating from May 1897. I am sure the early ones were not carbolised.

17,519. Do you know when the method of adding carbolic was first adopted?—No, that was before I came to the laboratory. I came to the laboratory in June.

17,520. Since then, all the bottles have been carbolised?—Yes.

17,521. Do you think that it is possible the putrid bottles we have heard of may all have been sent out before that period?—I know that bottles alleged to be putrid have been sent out of the laboratory since I joined the laboratory.

17,522. How do you account for this? Do you think the carbolic can have been omitted, or that it can have evaporated?—I think the officer who tests this is an exceedingly careful worker—Dr. Paymaster—and, I do not think, in any instance, he has failed to carbolise the flask. But, of course, an accident may have occurred. As to its having evaporated afterwards, I really could not say. I should think it was possible.

17,523. You say that in certain cases, where the decanting staff found that the vaccine was contaminated, you found, when you came to test the bottles, there was no contamination?—Yes, that is so.

17,524. How comes it that the decanters were so careful in the matter of not introducing bacteria into the bottles, when they were so little careful in the matter of not introducing contaminations into the agar tube? You say they introduced contaminations into 50 per cent. of the agar tubes, and that none the less you found that they did not introduce any contaminations into the bottles; how do you think that came about?—In the one case the organisms fall on a fertile surface, in the other in an antisepticised fluid. The men whom we were obliged to take to do the decanting were men who would be laboratory boys at home, absolutely ignorant of what bacteria are or anything about them. It was hopeless at first to get them to do the work properly.

17,525. How is the vaccine standardised?—Professor Haffkine does that.

17,526. Do you know how it is done? Is there any trade secret as to how it is done?—No.

17,527. Do you know how it is done?—Yes, I know M. Haffkine judges by the amount of sediment in the fluid; he compares the amount of the sediment. *This* bottle (shaking it up and holding it up to the light) he would probably mark 10 c.c., and *this* (shaking it up and holding it up to the light) would be about 5 c.c.

17,528. Do you think it is an accurate way of standardising?—Personally, I do not.

17,529. Do you think you could get a fluid of more constant strength if you decanted off the supernatant fluid?—Yes, I think it would be possible to get a more constant fluid.

17,530. Do you know whether the supernatant fluid is or is not toxic?—I do not know. I mean to try that.

17,531. You have not compared the toxicity of the supernatant fluid with that of the sediment?—No.

17,532. When you say the microbes disappear from the blood soon after death, do you mean that in a case where you have been able to see them under a microscope the bacteria disappear from view in a few hours, or do you mean that after a lapse of hours you cannot get cultivations?—We cannot get cultivations.

17,533. But can you still see the bacteria?—You can see forms which you take to be plague, but, as a rule, you cannot get satisfactory cultivations. Of course, I have examined plague rats 16 hours after death, and got plague bacillus from them both in microscopical tests and in cultures; but, as a rule, the plague bacilli

are crowded out by putrefactive bacilli—absolutely crowded out.

17,534. Have you examined the blood in a dead rat on two successive occasions, and have you, on the first occasion, found the microbes, and on your later examination, failed to find the microbes?—No, I have not.

17,535. Do you know whether the strength of the prophylactic decreases when it is exposed to a boiling temperature?—No, I do not know that.

17,536. Have you made any experiments to determine that point?—No; and I have no experiments also with regard to doing anything to the fluid after it has been decanted.

17,537. (*The President.*) What is the reason for the selection of bottles of the shape used?—Because you can fill up the syringes more easily from them. The neck and the body of the bottle are in the same plane.

17,538. It depends upon the length of your injecting needle?—The needles which we have are all long. We can put them in about *here* (pointing to bottle) quite easily, and in pouring out the fluid you can get the whole of the fluid out.

17,539. In practice, is it found necessary to pour the whole contents into one glass?—In the rules we specially say that that is not to be done.

17,540. You can hardly empty the bottle otherwise?—I have never any difficulty in emptying the bottle.

17,541. This prophylactic fluid, apparently, consists of two substances, one liquid and one solid?—Yes.

17,542. Which is the prophylactic ingredient?—The solid.

17,543. What is the function of the liquid?—Professor Haffkine, I believe, considers that the fluid part has an effect on the case mortality—that if a person who has been inoculated gets plague the fluid portion of the prophylactic helps him through with it.

17,544. On what grounds do you say that the solid is the prophylactic?—M. Haffkine has told me so. It is not my own observation, because I have done no experiments on the point. I have simply been working under him.

17,545. Is there any special test to determine the prophylactic efficiency of any brew before distribution?—We do not test it in any way.

17,546. You judge simply by the amount of solid matter?—Yes. Of course Professor Haffkine does all that himself. I have nothing to do with that.

(Witness withdrew.)

Lieutenant J. K. CONDON, I.S.C., called and examined.

17,547. (*The President.*) You are Under-Secretary to the Government of Bombay?—Yes.

17,548. (*Mr. Hewett.*) You were employed, I believe, on plague duty at Bantwa, a town in a Native State in Kathiawar?—Yes.

17,549. What is the population of Bantwa?—It is calculated at 8,500. The 1891 census was 8,200 odd.

17,550. At what stage of the epidemic did you arrive at Bantwa?—I arrived about the 10th September 1898.

17,551. The epidemic was a very severe one, was it not?—Yes.

17,552. What was the total number of attacks?—944.

17,553. That represents about 11 per cent. of the total population of the town?—A little more.

17,554. Can you give us an estimate of the number of people who had left the town?—I think about 500 or 600. It is calculated there were 7,500 people there when I was there.

17,555. What number of deaths occurred in the epidemic?—602.

17,556. When you got to Bantwa in the month of September what measures were in operation?—It was raining very hard, and practically there were no measures taken beyond the erection of hospitals and some small camps.

17,557. On what date were measures to clear the people out of Bantwa undertaken?—Between the 25th and 30th September.

17,558. What proportion of the total attacks and deaths had taken place up to the date when you got the people out?—A certain number of people had been turned out by my predecessors in August, but unfortunately a storm took place and they all went back again to the town. That settled the question. 772 attacks and 467 deaths took place before the people went out the second time.

17,559. When did the storm take place?—On the 12th September. There were about 2,000 people segregated from the time of the end of August.

17,560. Did those segregated by the end of August include all the people among whom the plague broke out, or was there also plague among the other people in the town?—No.

17,561. Were the whole of the residents of the infected portions of the town in camp or not?—No, because the infection was all over the town.

17,562. Was the worst part of the epidemic over before September 16th, the date when you were able to begin effective measures?—Yes, apparently; or at least it had reached its climax.

17,563. What was the number of attacks respectively before you took effective measures for getting the people out of the town, and after you had done so?—467 deaths took place before evacuation, but I should like to explain that evacuation, at least as I understand it, never took place in Bantwa at all. There is absolutely no reason, so far as I can see, which anyone can give for the subsidence of the plague there.

17,564. Except that the disease itself began to die out?—Yes. There were never more than 2,000 people—one quarter of the town—evacuated. The decline in the disease might have been due to the weather, because we had a spell of very fine weather immediately after the storm.

17,565. Did anything come under your observation as to the communication of the plague by rats in the town of Bantwa?—In a great many of the houses which were badly infected dead rats were found. In one house in which 16 cases took place we found a lot of rats.

17,566. Has your experience led you to the conclusion that the rats were moving from house to house and carrying the infection in that way?—Yes, for this reason: in the town when plague began the houses where rats were caught and killed were, of course, disinfected, but rats afterwards came to where we were living, and, in fact, appeared in our own stables. On finding them we turned the servants out and disinfected the rooms. None of the servants were attacked.

17,567. Did you observe distinctly the migration of the rats?—I do not think I could make that statement, but that was the general belief. I think they were driven from one place to another, although, of course, I did not see them. It was only a distance of 1½ miles or 2 miles.

17,568. Did any other place in the neighbourhood of Bantwa become infected?—All the surrounding villages—four or five of them within a radius of 3 or 4 miles.

17,569. Were you able to trace the cause of the infection of any of those villages?—Not with certainty.

17,570. Did you turn the people out?—Yes; in the villages every person was turned out.

17,571. Did the epidemic last long in any one of those villages?—I think Nakra lasted within a month as long as Bantwa itself. It was going on after Bantwa.

17,572. Did it begin at the same time?—No, five or six weeks later. I do not think there is any doubt that Nakra was infected from Bantwa.

17,573. When you got the people out of these villages did you prevent any communication between them and the infected site?—As far as it was possible, but I could not rely upon the Police there. They were all State Police and unreliable. In fact, in some cases people did get back again, and the Police were punished in consequence.

17,574. So that you have no security that the segregation of the people was at all effective?—In one village it certainly was effective, and that is Kambhla.

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17,575. How long did it take to suppress the disease in that village?—The epidemic in Kambhla began at the commencement of October and it stopped in the first week in November. There were 23 cases with 21 deaths.

17,576. Why should it have taken so long to suppress the outbreak there if segregation was effective?—Because the people kept going back from the camp to Bantwa.

17,577. Bantwa was also infected at the time?—Yes.

17,578. Then the segregation was not effective in preventing the people who were segregated from going to an infected site?—No, it was not. What I meant was they did not go back to Kambhla.

17,579. But they went to other infected places?—Yes; there is no doubt they went to Bantwa and they might have been to Nakra.

17,580. (*Dr. Ruffer.*) Can you tell me what was the shortest duration of a case of plague that you observed personally?—The shortest case I personally observed was that of a man at work in the fields about 6 o'clock in the evening; he was cutting the crops. I happened to be riding back from Bantwa at night, and they said that this man was taken ill. I saw him between 6.30 and 7 p.m. When I went back the next morning I found he had died about 9 o'clock. That would be about 14 hours. This was the shortest case that came under my own observation. It is possible that many of the cases found dead were more rapidly fatal.

17,581. Did you notice dumbness as one of the sequelæ of plague?—Yes, dumbness came on when the people had had plague about a day or two in hospital. You could not get them to answer, they used to shake their heads.

17,582. Did you find that people who recovered became more or less idiotic?—We had four or five cases of lunacy after plague.

17,583. How long did it last?—I do not know.

17,584. Did they recover?—I cannot say.

17,585. You mention in your précis that loss of sight followed careless handling of the bubonic discharge in some four or five cases; do you mean the patients got ulceration of the cornea?—They lost their sight altogether; the eyesight went.

17,586. Did they get disease of the eye?—The eyes became quite colourless; the blue became a whitish blue. In some cases the eye was lost altogether.

17,587. Did the eye suppurate?—It became very much inflamed and painful. To the best of my recollection there was suppuration and a discharge from it.

17,588. Why do you think it followed careless handling of the bubonic discharge?—That is the only reason we could assign to it. We would open a man's bubo and then he would have to squeeze it himself and wipe it. Very often he would squeeze it carelessly with his hand and then rub his eye or his face or something of that sort, and it was generally after that that it came on. I think there were some six cases of loss of sight altogether.

17,589. I understand you saw one house where there were 16 cases, and some occurred after it had been disinfected?—Yes, that was a most extraordinary case.

17,590. Can you give us the details of that?—I regret I cannot, because cases occurred before I went there—about eight or ten of them. The house was pointed out to me as the worst plague spot in the city. It was in the very centre of the city.

17,591. At that time the plague was all over the city?—Yes.

17,592. So that these people may have infected themselves somewhere else?—That is possible, but all the cases occurred in the house.

17,593. (*Mr. Cumine.*) Has there been any case in Bantwa this year?—Not this year.

17,594. No case since it ceased last year?—Since it ceased on the 5th November there has been no case reported.

17,595. (*The President.*) What kind of house was it in which these 16 cases occurred?—It was a collection of houses; a house with rooms added to it all over the place. It was not strictly a group, but it was built up of several houses. It was in a compound by itself surrounded by a wall from 5½ to 6 feet high.

17,596. What do you mean by dumbness, that the patients were speechless?—Most of them were not absolutely speechless, but some of them were. The majority could make sounds, but they were not intelligible; they could not speak distinctly.

17,597. Did the voice go?—The articulation seemed to go.

17,598. (*Dr. Ruffer.*) Is there any medical man in Bantwa?—On my arrival I found the plague work entirely in the hands of State Hospital Assistants.

17,599. During the whole of the epidemic?—Khan Saheb Fazl Ahmed arrived shortly (about ten days) after I did, and did good work.

17,600. Was there any European Medical Officer?—No. I believe Major Burke, Civil Surgeon at Rajkot, visited the Plague Hospitals in August, but beyond this none of the patients were even seen by a European Medical Officer.

(Witness withdrew.)

Mr. S. R. Arthur, I.C.S.

Mr. S. R. ARTHUR, I.C.S., called and examined.

17,601. (*The President.*) You are Collector of Kolaba?—Yes.

17,602. (*Mr. Cumine.*) During the fair weather of 1896-7, you were in the Satara Collectorate?—Yes.

17,603. I think some parts of Satara are very much over-populated, and a great many of the people come to Bombay to work as porters, and so forth?—Yes.

17,604. When the exodus from Bombay occurred in 1896-7, did a number of those people go back to their own country?—Yes; and the result was that some two or three villages became infected. I found a number of deaths ascribed to ordinary fever, and afterwards I thought that probably a very large number of those were due to plague, because I noticed they occurred among people who had returned from Bombay. At the time nobody knew much about bubonic plague, and I did not go into it till rather later; but I noticed that several cases occurred together. One man came from Bombay, and died of fever; and just after that, within a fortnight or so, there were several cases of fever in the village, all of which proved fatal very quickly.

17,605. Was there one village which seemed to escape infection in a wonderful manner in spite of a lot of people pouring into it?—Yes, Wai.

17,606. Where did the refugees come from?—A tremendous number of people came from Poona every day.

17,607. And yet that village never got infected?—That is so.

17,608. In March, 1898, you went as Collector to Kolaba?—Yes.

17,609. In the Kolaba District, I believe, there were three centres of plague?—Yes; one, Revdanda and the neighbouring villages; secondly, Karanja and neighbouring villages; and, thirdly, the town of Alibag itself. Panvel was also infected, but the plague stopped just when I arrived in the district.

17,610. With regard to Revdanda and its villages, you have no personal knowledge?—Not very much. I went down there, but there was an officer on special plague duty there.

17,611. With regard to Karanja and its neighbouring hamlets, what was the important point which struck you most?—The course of the plague at Karanja and the neighbouring hamlets in the Uran petha of the Panvel taluka demonstrates no less clearly than Alibag the advantages of evacuation. I went there first about the 23rd March 1898. Four or five cases were then occurring daily. The late Mr. Brooke, my Assistant, had already ordered evacuation just before my arrival, and the order was complied with, but the people were concealing cases, and we had some difficulty in impressing on them the importance of giving immediate information of cases and deaths. Eventually the people promised to comply, and did so loyally. Panches

were appointed, the hamlets were divided into sections, and one Head man held himself responsible for each section, and gave information of cases and deaths immediately on their occurrence, on which the huts in which cases had occurred were burnt down and the occupants segregated. The result was immediately apparent. The number of cases dropped from 23 and 24 in the weeks ending 19th and 26th March respectively, to eight in the week ending 2nd April, three in the week ending 9th, and none afterwards, except a sporadic case here and there. What chiefly struck me was how very quickly it stopped when we got the people out and got the cases immediately reported.

17,612. But the way in which the people found out cases themselves and reported and isolated them was also striking, was it not?—Yes; we had no difficulty with them at all directly they understood what we wanted, and when they knew that we were not going to do anything with them except to put them in different huts.

17,613. With regard to the town of Alibag itself, I think you arrived there just at the beginning of the second epidemic?—Yes.

17,614. The point which you wish to emphasise is, I understand, the number of attacks in the season of 1897–98 as compared with the number of attacks in 1896–97, and the cause of the difference?—Yes. The history of the plague in Alibag is most instructive as showing the advantage of early evacuation. In the first half of the year 1897 there were 266 cases and 244 deaths. This was the first attack. The plague came on the people as a disease of which they had no experience; they did not at that time appreciate the advantage of evacuation, and were slow to resort to it. From July 1897 to March 1898, Alibag remained free, with the exception of one case in October and three in January. When I took over charge of the district on 19th March 1898, the second epidemic had just commenced; seven cases had occurred, and my predecessor, Mr. Quin, had ordered the evacuation of the infected quarter. I continued his policy, and on cases occurring, immediately caused the evacuation of the affected parts. Nor did I find any difficulty in inducing the people to obey the order. Taught by the bitter experience of the previous year they were only too ready to leave on the first appearance of the plague. The results are apparent in the returns. The first three weeks showed 17 cases, the following four weeks showed nine, and the attack then ceased, May, June, and July each producing one sporadic case only.

17,615. From July 1897 to March 1898 Alibag remained free?—Yes, with the exception of one case in October and three in January.

17,616. Do you know whether the outbreak which had just begun in March 1898 was due to an importation of infection about that time? Could you trace importation of infection in February or the beginning of March?—I am afraid I cannot say, because it began some days before I joined there. I did not look into the matter myself. I can speak with regard to the latter epidemic into which I did inquire myself, but I was not in the district when these first cases occurred, and I am afraid I cannot say whether they were imported or not.

17,617. When did the second epidemic in Alibag, which was going on when you arrived there, end?—In epidemic form on 29th April. There were subsequently only three sporadic cases in May, June, and July, one in each month.

17,618. Has plague appeared in Alibag again this fair season?—Yes, it is going on now.

17,619. Can you trace its re-appearance in Alibag to any fresh infection imported?—No, I think not. It started with a great mortality among rats long before cases were reported to me. For about a fortnight or three weeks before there was a great mortality among the rats.

17,620. Have there been any imported cases?—I think not. I think it is a pure recrudescence in the place itself.

17,621. Did it reappear in the part of the town where the last epidemic died out, or among the people among whom the last epidemic remained the longest?—No. This year it is more among the Brahmans, whereas last year it was chiefly among the Kolis, who live quite in a separate quarter.

17,622. What disinfectant had you used during the epidemic which was going on when you arrived in Alibag?—We have used perchloride of mercury all through; we have also, of course, unroofed the houses.

17,623. Did you disinfect every house or only the houses where you thought cases had occurred?—We disinfected the houses in which cases had occurred and also the surrounding houses. I think a good part of the town was probably disinfected.

17,624. But some of the houses were left undisinfected?—Of course Koli Wada received the most attention, where cases were occurring last year. Nearly all the Koli Wada was unroofed and disinfected, and as yet we have had no cases occurring there, although rats have died.

17,625. There were a certain number of houses which were left undisinfected?—I cannot say that the whole of the town was disinfected, but the greater part of it was.

17,626. Who was in charge of the disinfecting operations in Alibag town?—The Deputy Collector, and Assistant Surgeon Pereira.

17,627. As regards the mortality since April to this present recrudescence you have been watching it carefully, I suppose?—Yes.

17,628. Have you noticed whether the mortality in the interval has been heavy among children under five?—I could not say.

17,629. Have you noticed whether the deaths have been occurring in clusters, or more than one in the same house?—Do you mean during the time there has not been any plague?

17,630. Yes?—No, I do not think so. I have noticed carefully the mortality from fever, but nothing else particularly. If several cases of fever had occurred in one house, or in a cluster of houses, we should have noticed that at once, and probably ascribed it to plague.

17,631. You have been looking not merely to the number of deaths but also to the places where they occurred?—That is so. There are general orders in the district. If in one house or in one neighbourhood a large number of fever cases occur we immediately get reports of them.

17,632. Are you aware whether there has been any outbreak of mumps in Alibag during the rains?—Not that I know of.

17,633. I think that in Mora Bandar in the hot weather of 1897 about 393 persons were inoculated?—Yes.

17,634. Were you there at the time?—No, I was not.

17,635. Have you any personal knowledge of what has happened to those people, how many of them are dead and how many are alive?—I have no personal knowledge, but I think I could say generally that Mora has not been affected with plague since. Of course that is astonishing, because Mora is a bandar exactly opposite Bombay, which is very much used, and it is only four miles by road from Karanja, which was very heavily attacked. I did not go to the district till 1898, but from the hot weather of 1897 there has been no plague at Mora, although it is a place which has considerable traffic with Bombay.

17,636. I think that Alibag and Panvel, and also two villages named Thal and Naogaon, are infected at present?—Yes, and Cheul has also been infected since I wrote my précis of evidence.

17,637. How many villages are now infected?—Three. Of course, I am not counting sporadic cases. We are perpetually getting single cases imported from Bombay and other places; they are removed at once, the house is disinfected, and, generally, no further cases occur if the measures are taken promptly.

17,638. You have three villages now with indigenous plague in them?—Yes.

17,639. Does any one of them adjoin a village which was infected last year?—Panvel has been infected each year. I have no villages infected now except Cheul.

17,640. Does that village adjoin a village which was infected last year?—Cheul was infected last year, and so was Revdanda.

17,641. How is plague carried from village to village?—Is there any case known of rats being actually seen

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migrating from one village to another?—No, I do not know of that.

17,642. Do you think it would appear to be carried by human beings?—Yes, but I think it is also very likely carried by rats.

17,643. But you have never seen any rats actually going from one place to another?—We know it is carried from one part of a town to another by rats.

17,644. How do you know that?—I say this because mortality amongst rats has been observed first in one part and then in another; then, within a fortnight or three weeks, one sees plague among human beings. That is the history of plague in Alibag this year.

17,645. Could you be confident that there has not been first a concealed case of plague among human beings in that part where rats have been dying?—I do not think that there has.

17,646. Do you believe in disinfection by perchloride of mercury?—I believe the sun is by far the best disinfectant, because I think it is very difficult to disinfect thoroughly with perchloride of mercury.

17,647. Is it not difficult for the sun's rays to operate in dark houses?—We unroofed almost entirely. I do not believe in taking off a narrow strip, because, of course, the sun reaches very little.

17,648. It would not be feasible to unroof during the monsoon?—No.

17,649. Then you cannot rely on disinfection by the sun during that time?—No.

17,650. Do not you think that the monsoon is a favourable season for plague outbreaks in this part of the country?—As far as my experience goes it has stopped almost entirely before the monsoon. I do not think that in Alibag we had any cases last year, or in Panvel. Each of the infected towns in Kolaba was infected in the cold weather, and the cases dropped off as the hot weather came on. In the rains there were no cases at all.

17,651. There was a great deal of plague in the Satara district in the rainy season, I think?—Yes, in Karad.

17,652. Does not that modify your statement that it does not occur during the rains?—I was speaking with regard to my own experience, but I was also in Satara. The only town in which it occurred last year during the rains was Karad.

17,653. During the rains would you not have to resort to some other method of disinfection?—Yes. I have not, myself, taken plague measures during the rains anywhere; but, of course, I should try to evacuate houses as far as I could, and introduce inoculation.

17,654. But you would have to let the people back into their houses at some time?—Yes.

17,655. Do you think that it would be impossible to effectually disinfect the houses with perchloride of mercury?—I should think that disinfection with perchloride of mercury should be done in the rains; I only said that I thought sun disinfection was the best which one could get. We have a large staff of disinfectors, but I think it is very difficult to get work done very thoroughly so that every atom of space is covered.

17,656. The work involves a lot of supervision?—Yes, and we have not sufficient means of supervision.

17,657. (*Dr. Ruffer.*) Why do you think the sun is the best disinfectant?—From experience it seems to me that directly one unroofs a house that is quite enough to stop everything. We always unroof the houses.

17,658. But you disinfect the houses as well, do not you?—Yes, we generally do, but we unroof a great deal more than we disinfect.

17,659. I want to know on what evidence you base the statement that the sun is the best disinfectant?—I am speaking, of course, from what I have learned from the doctors.

17,660. You have no facts of your own?—No, I have not.

17,661. (*The President.*) Have you had cases in which, having unroofed the houses and allowed the people to return, plague has occurred again in the same house, independently of a fresh importation?—My experience of plague is confined to the hot and the cold weather. When we once evacuate a house, the people themselves do not wish to return till the rains, so that a house remains empty for three or four months generally.

17,662. But they do return at the end of two or three months?—Yes.

17,663. Assuming they return, has plague ever occurred in houses which have been opened up, apart altogether from fresh importations?—Not that I know of.

17,664. It has, therefore, proved practically effective in your experience?—Yes, I think so.

17,665. Do these cases which you speak of include cases in which the houses have not been otherwise disinfected?—No, it does not, because every house in which the plague cases have occurred is otherwise disinfected.

17,666. Your opinion seems to be that evacuation is a very effective measure?—I think it is the most effective of all except inoculation.

17,667. In many cases you have been able to stop plague which has been imported by at once segregating the infected persons?—Yes.

17,668. In order that that measure should be effective you must obtain early information?—That is the most important thing of all.

17,669. What is your organisation for obtaining this early information?—We do it through the district staff. There are general orders in the district about plague. When cases of fever occur in a house or in a cluster of houses in a village one after another, they have to be immediately reported.

17,670. Who reports them?—The village officials report to the Mamlatdar, who reports to me direct. Probably I should know at least within two days.

17,671. How does the village officer obtain the information?—In the ordinary course he has to enter births and deaths in the register immediately on their occurrence and has to keep himself informed for the purpose.

17,672. Before the plague patient dies he may spread the infection widely in a village or town: have you any means by which you can determine that there is a case of plague before death has taken place?—No, I am afraid we could not tell that: I do not think we could ever know until one or two cases had occurred.

(Witness withdrew.)

Dr T. Blaney.

Dr. T. BLANEY called and examined.

17,673. (*The President.*) You are a practitioner in Bombay?—Yes.

17,674. You have been here for a long time?—I have been practising here for half a century, a little more perhaps.

17,675. You have taken much interest in the affairs of the city?—Yes. I have occupied every position which a non-official in a city such as this can occupy.

17,676. You have paid much attention to the epidemics of plague?—I have followed them; I have put aside everything else to pay attention to them.

17,677. In the first place, what is your opinion with regard to the influence of rats in the diffusion of plague or to the introduction of plague into any part of the town?—I submitted some remarks on that point in a paper which I sent to the Plague Commissioner, Bombay, according to his own request. I said in this:—

"One more item of evidence may be offered in connexion with the spread of plague by rats. This evidence is derived from experience in our wet-docks. The docks were filled with ships during both our plague epidemics. During these epidemics the usual interchange of rats between the docks and the shore continued as formerly, and that the interchange should be considerable and not rare or occasional may be inferred from the fact that the great rat infested granaries of the city are situate immediately in front of the docks and at no great distance from them. When the question is asked: 'How were the ships in 'the docks affected by the rats on board?' the

reply is, 'The rats carried no infection to the crews of these ships.' As far as I know, if infection reached the ships at all, that infection was brought there by persons infected in the town, and was not carried on board by rats. It is indeed a remarkable fact that while plague raged all over the Mandvi district, the crews of the ships in the docks remained uninfected during both epidemics, while the distance between the shore residents and the ships was well within striking distance of the infection. It may be mentioned that the crews of the ships in the docks were largely composed of Muhammadans and Portuguese, classes very susceptible to plague infection, and not wholly of Europeans or immune persons. As rats do not desert houses during a plague epidemic on account of the disease, they do not carry the plague from house to house or from district to district. The only influence they exercise on plague may come from their power to increase or intensify the infection existing in the houses by their excretions during the period of infection, or by their bodies after death. The proofs of this power of infection by rats, or the power of rats to carry and spread infection, are yet wanting. It is known, however, that plague may continue in active evidence as well without rats as with them. Rats are not an essential factor in a plague epidemic. Hence when we hear that somebody has killed a thousand or ten thousand rats, the reduction is no proof that plague has been diminished to that extent."

17,678. Will you favour the Commission with your opinion as to what influence rats have in disseminating plague?—Very little, I think. Where rats leave their excretions in the houses, on the bedding, clothes, and so on, while they are infected, they may possibly disseminate the plague in houses, and also when they die on the premises and remain there they are a great source of infection. That I have seen over and over again.

17,679. But they do not diffuse it widely?—No. The crucial point about that is the evidence with regard to the docks, which I have already given.

17,680. What opinions have you formed as to the conditions which influence the rate of plague mortality?—There are different degrees of susceptibility in the classes which are constantly maintained.

17,681. Race susceptibilities?—Yes, and diet susceptibilities, or the susceptibility of habits. I have worked out these figures again and again, but I went through one complete epidemic from the beginning of July and ending the following July. I have worked it out in 20 different ways in 20 different communities in different parts of Bombay, and the figures are almost identical. The table which I have before me contains the official record of plague deaths during the whole period of the duration of the second epidemic, namely, from the week ending the 6th July, 1897, to the 28th June, 1898. With regard to the Jains, a particular caste here who are jewellers, grain dealers, and generally wealthy, the great trading class, the rate of mortality from plague is 38·05. I believe some doubt has been thrown upon the correctness of this rate by the late Plague Committee, Sir James Campbell's Committee, but I have been in correspondence with people in America and different parts of Europe, savants, and also people who are interested in the trade with this city, and I have been able to dissipate the errors which appear to me to be in the report of that Committee.* The rate of mortality among the Jains, surprisingly large as it is, is real, and it is due to the fact that animal life is sacred among the Jains. They will not sweep their staircases or sweep their sleeping rooms out, or their cooking room very often, lest they should destroy some animal life, so scrupulous are they. Only half of the vegetables which are used by the natives in Bombay are eaten by these people, because animal life has been found in them. There are sundry other social peculiarities about them which render their sleeping places and cooking places particularly susceptible to the attraction and preservation of the infection.

17,682. Are these places very dirty?—Not in that sense. They are wealthy people, and their places look comparatively clean. But if there is such a thing as infection which is not apparent to the eye which might be got rid of by brooms and disinfectants and throwing open windows and allowing the light and air to enter and so on, that infection would remain so far as the Jains are concerned. I have seen numbers attacked in the same house again and again where, ordinarily speaking, from their social position, wealth, and so on, they ought not to be attacked. That is the explanation with regard to the Jains. There are those religious peculiarities in them which keep the death-rate at that great height, and it will always remain so.

17,683. That is the plague death-rate?—Yes. I have gone over the statistics for about 25 years with the same community so as to verify or shake the opinion which I have formed about their mortality, and their mortality is in excess of all the other Hindu populations, apart from plague in ordinary years.

17,684. Are their habitations otherwise rather better than the average?—They are. The next on the list are the Bhatias, which is also a very wealthy caste. They hold the whole of the grain trade of Bombay, which means millions, and also the ghee trade, to a great extent, the cloth trade, and many other trades. Their death-rate is 26·48. The difference between the Bhatia death-rate and the Jain death-rate is this, that the population upon which it is estimated is much smaller, the Jains being four times as large as the Bhatias, 25,000 to 6,000. Therefore the figures are, of course, more reliable for the Jains. The Bhatias are a small class, but their mortality must be very large, because, with all their wealth, they ran away from Bombay until there was not one-third of the population of Bhatias left in Bombay, which ordinarily exists here, and still their death-rate for the second epidemic was 26·48, and it was the same the first year. The death-rate amongst them must have been very heavy. I will take next two together, because they are Hindus, one low caste and the other high caste. The difference between the two is only a matter of degree of poverty. There is not much difference between them. Formerly the low-caste Hindus used to eat all kinds of offal and bad stuff, but they do not do it now. They are more well-to-do, being in good employment, and there is no necessity for them to it. The death-rate in the higher caste is 21 per 1,000 as against 24 in the low-caste Hindus. I think those ought to be taken together, giving an average of 22½. The next are the Brahmans, which is an important caste. They are supposed to be of cleanly habits, and they belong to the intellectual classes. They are not in great poverty, and where they are in poverty they prefer it, being professional beggars and living well by their trade. Their death-rate is 20 per 1,000. The next is the native Christian, which is a poorer population. They are what we may call Hindus Christianised. Practically in lives, habits, and hopes they are Hindus. Their death-rate is 15. That shows that, being Christianised, they have improved somewhat, because their death-rate is lower than that of all the classes in the Hindus. When they are Christianised they eat everything. They go in for pork and turkey, roast beef, and so on.

17,685. They do not live in better houses?—No, they are poor. The feeling of the other Hindus is against them. It is hard work for a Hindu to be a Christian in his native country. They are not very well treated, because they are Christians, but their diet is certainly superior, and I think that accounts, to a considerable extent, for their lower mortality with regard to plague. I believe that the native Christian returns are fairly correct. Next come the Parsees, 9·42 per 1,000. They are, of course, a clean-feeding and well-fed people and intelligent, and they have rather a small mortality. The Muhammadans come next, 9·44, which is practically the same. The Muhammadans and Parsees stand upon the same level; their diet is very similar, the only difference being that the Parsees never eat beef, and the Muhammadans always do when they can get it. Then come the Eurasians with a death-rate of 7·30 per 1,000. That is rather high. I do not know why it should be so, because their houses are fairly good and their diet is exactly like ours; there is no difference. Still, they do get attacked in very much larger proportion than the pure Europeans, and when they are attacked they die very heavily. Then come the Jews, which is 5·7. They are a very clean-living population, but their numbers are very small. There are only 4,000 in the whole of Bombay. Still, I think this is a fairly correct representation. Lastly, the Europeans have a mortality of 1·96 per 1,000; they are almost immune.

17,686. Do you think it is entirely a question of race in the case of Europeans?—Habit, diet, housing, and

* Report of the Bombay Plague Committee on the plague in Bombay from the 1st July 1897 to the 30th April 1898, by Sir James Campbell.

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even clothing, I think, are all represented. I think, if this table were constructed 50 times over in 50 epidemics the figures will turn out the same. I have tried it in the last three epidemics, and it is wonderful how exactly they do work out.

17,687. To what extent do you think that poverty influences the mortality?—Exactly to the extent that it affects the mortality in ordinary years, not more. That would be, perhaps, in a ratio of 5 to 10.

17,688. To what extent do you think the housing of the people affects the mortality?—There the Commission has hit the great point. I think Lord Sandhurst's scheme is almost an answer to this; overcrowding is *the* great question in Bombay with regard to plague, with reference to the extent, the severity and preservation of infection in houses. I think this is the great blot on the Bombay system. If the Commission will spare me five minutes just to show them how 400,000 out of our 800,000 live, perhaps it will explain it in a nut-shell. The system is to get house accommodation on the cheapest terms. A single man has 10 rupees a month as an income. If he is a single man he goes to a man who takes in borders and lodgers, and says to him, "Here are 2 rupees 8 annas a month for you, "and you must feed me and give me a place to lie "down in." That is all he asks for; there is no furniture of any kind. The man says, "No, but I will "do it for 3 rupees." That leaves him 7 rupees of his salary untouched. The 3 rupees would include all his food and his house rent. It would not include his clothing or his betel-nut. This is the extent to which he pays for his actual subsistence, and more than that he will not pay. Our Municipality, for years past, knowing deliberately that the great mortality in excess of what it ought to be was caused by this overcrowding, has absolutely made laws—and never attempted to carry them out. I have roared myself hoarse at the Municipal Board meetings again and again for the last 25 years on this subject, and at last Lord Sandhurst's scheme. I suppose, is going to show you the difficulty can be got over. I have given up public life and public work, but I was pressed to go upon this new Trust; they placed me there as a member, and I hope that this overcrowding question will be properly looked into, even if we are going to spend a million, 2 millions, or 5 millions. The dispute at present between Lord Sandhurst and myself is this: he says he will do it for 5 millions, and I say he will not do it under 10 millions. The money would only be rightly spent when the overcrowding is abated. In a simple epidemic of any kind, be it our usual seasonal fevers, measles, or what not, you can go along the verandas and see the people lying there—all attacked in the same way—because they live too closely to one another, and breathe into one another's faces. I only wish to emphasize as much as I possibly can that the overcrowding has had a great deal to do with the intensity of the epidemic and the greatness of it.

17,689. What evidence have you that overcrowding has had an influence upon the incidence or mortality of plague?—I can only say in a general way that I believe it has kept it up and intensified it.

17,690. You have no figures?—No, it is very difficult to get them.

17,691. Can you tell us if plague has occurred chiefly in insanitary houses or insanitary districts?—Yes. I think it may be generally answered so, although, if you ask me if I have seen a great number of very good houses in which plague has been very heavy, I should say yes. I saw that in Mandvi. But as a rule, I think it has occurred in insanitary houses, because when you come to the outlying districts which contain the poorest population and the worst houses there we see the plague has the greatest intensity.

17,692. By insanitary dwellings or insanitary conditions, what do you include besides overcrowding?—Darkness, dampness, and want of ventilation. They are rookeries in lots of cases. In many of the outlying districts a man can hardly stand upright in his house. They are not fit for human habitation at all.

17,693. Do you believe the plague has been influenced by the mental state of the people?—At first it was so.

17,694. On what do you form that belief?—For three years I have had no income in December, January, and February. It was said, and there is some truth in it, that I have the largest medical practice of any man in Bombay, probably due to my very long acquaintance with the natives, and in December, January, and February, they will not come to me, nor will they send to me for fear of the plague officials carrying them off.

17,695. Are you a plague official?—No, but the plague officials follow me. The day before yesterday a wealthy gentleman sent for me. He said: "I was "going away to my country and only wanted you to "see that I was in good health before going away, "but immediately after you had gone two or three "plague officials came here and said: 'Dr. Blaney "'was here; what is the matter; show me your wife; "'show me your servant.'"

17,696. Do you think this state of anxiety has actually affected the mortality?—It did during the first year, but it is not doing so now. The people are brave now.

17,697. Have you been able to measure the effect? Can you state it in any definite form?—Not in any definite form. I was the Registrar of the cholera deaths in Bombay 50 years ago for the Government, and I used to collect often 100 death certificates in a day from cholera. The people took it as being quite a matter of course—it might be catarrh, or diarrhœa, or anything—nobody bothered about it. They took it very philosophically, if that word can be used in such a connection. That is the feeling now. There is nobody who has any fear now. I have, in the first year, seen insanity, following the fear of the measures, again and again.

17,698. How has the mental condition influenced the mortality of plague to your knowledge?—That would require a long time to answer. The statement made in my précis refers to the first year when the people were disturbed with the operations. It was that fear which influenced the mortality. I have seen over and over again people just lying down and giving up, where, under other circumstances, if there had been no fear, they would have, perhaps, striven against it and taken remedies, and done things which they would not do under that fear.

17,699. Have you any knowledge as to how long plague if uninterfered with would last in a city or district into which it had been introduced?—I think it has its cycle of years, but that, of course, is only supposition.

17,700. You have had some experience of the use of curative serums?—A little. In my practice I have estimated that I have done about 24 inoculations, with Yersin's serum and Lustig's serum. I have used none of that which they are now making at Parel at the present time. I selected all the cases which I inoculated, and, therefore, I did not think I could put those cases forward.

17,701. On what grounds did you select them?—As being immediately attacked and as being in perfectly good health before they were attacked.

17,702. You got them in the early stage?—Yes, and I got a good result. The result was that in several of the cases there was almost immediately subsidence of the fever and of the bubo also.

17,703. How many cases had you?—About two dozen. I remember one case, where I stopped with the girl about 70 minutes after I injected her with Yersin's serum, and in that time the temperature went down from 105 to normal. She sat up in bed—she was a fine, young, strapping girl—and said, "Come here, Father, I want some breakfast." She sat down and had a very good breakfast. She was taken away to the hospital and treated there, but she had no further bad symptoms.

17,704. How many of the 24 cases recovered?—About 48 per cent.; nearly half. I did not keep an exact account because I did not think the cases were fair to put before the profession as evidence of the value of the curative serum.

17,705. They appeared to be fair as showing what the serum is capable of doing when the cases were got in the early stage?—Yes, I think so.

17,706. Besides reducing the case mortality, serum treatment had an effect on the course of the symptoms?—Yes, in a few cases.

17,707. What dose did you use?—20 c.c. I think 10 c.c. was given at a time and repeated some times three or four times. I remember one case in which, in consultation with Yersin himself, I gave six injections within 24 hours.

17,708. Did the case recover?—It was a case of pneumonic plague; we did not expect it to recover.

17,709. What do you think is the most efficient measure to adopt to check plague when epidemic?—The best thing is to run away from it.

17,710. Run away from what?—From the germs, from the locality. We saw segregation going on here for a whole year, and saw the people carried out of their houses but with no reduction of the disease.

17,711. In so far as general measures are concerned, which are, in your opinion, the most effective for controlling or preventing an epidemic, apart from removing a patient?—Cleanliness and keeping in the open air as much as possible. I have always advocated that the labouring population of Bombay should sleep outside the houses, whether it rains or not. If they go into their rooms their feet and heads are together, and the whole temperature is vitiated, and even supposing there was no epidemic, they incur every possible risk because of the overcrowding in sleeping rooms. We find that those people who sleep outside the houses are very rarely attacked—those who work out in the docks during the day and keep out in the air at night also, and only spend enough time in their rooms to take their food.

17,712. What do you think are the most important measures for protecting a town or district from plague?—I think you should get the people in the open places as quickly as possible, and encourage them by every possible means to go there. The houses themselves should be well ventilated, and as much sunlight let in as possible, and there should be daily scrubbing and scouring. The main thing is cleanliness, which is not observed in an oriental city at all under the best of circumstances.

17,713. (*Mr. Hewett.*) Has the proportion of deaths to the number of persons attacked been different in the different epidemics?—I am trying to get that question worked out now at our hospitals. I shall not be able to give a complete answer till June or the end of May. There seems to be an opinion abroad that in this third epidemic the cases die in the hospital very quickly, within 24 hours, very much more than they used to do in the first or second epidemics. From my casual observations in the visits I make to the hospitals occasionally it appears so. I see during the last week or two patients are living longer. In the first and second epidemics there would be many patients who lived to the fifth, sixth, seventh or eighth day, whereas at the beginning of the third epidemic in December last they were all dying in a day. Dr. Choksy told me that in they the month of December, in his hospital, it was the same thing, but it is not so now; it is undergoing a change.

17,714. Do you think that the proportion of persons attacked who died in the second epidemic was greater than the proportion of those attacked who died in the first epidemic?—The statistics are not exact. There has been no trouble taken at the burial and burning grounds with regard to verifying the cause of death, but the figures, such as they are, are equal in both years and in all classes and in the different districts, so that no answer can be given to that question. I believe in the two first epidemics it was as nearly as possible equal, but the Commission must remember that at least 400,000 people left the city in the first epidemic, and there was no such exodus in the second epidemic. This year the mortality is decidedly less up to the present.

17,715. Do you think that there has been any great difference in the number of cases which have escaped detection in each of the three epidemics?—No.

17,716. If the mental attitude of the people was so much disturbed in the first epidemic, why did not a larger number of the attacked die than in the other two epidemics?—I believe a much larger proportion of them died, as you will find if you reduce the population from 800,000 to 400,000 and work it out in that way.

17,717. You think there were more attacks by reason of the mental attitude?—No, that is not the statement. The statement is that they were badly affected by their mental attitude.

17,718. I understood you to say that a larger proportion of those attacked by the plague in the first epidemic did not die than in the second and third epidemics?—No, I have not said that.

17,719. Did not you say that you thought the proportion of deaths to attacks was much the same in the three epidemics?—Yes.

17,720. Is not that the same question as I asked you?—No; that is where the difference in population comes in. If correction is allowed for that, then the statement is correct enough.

17,721. The question of population does not seem to come in there at all. I understood you to say that the mental attitude of the people caused the disease to be more fatal among those attacked?—No; that requires a very much longer explanation than two lines, because it requires knowledge of the actualities of the case in the matter of segregation. I was at the Arthur Road Hospital one day when a cart came up with 11 bodies in it, nine of which were dead. That explained the mental attitude a good deal. But I think it is too large a question to be epitomised into two lines.

17,722. What is your experience as to the conveyance of infection from one person to another?—It is very little.

17,723. Why do you say it is very little?—Because we do not find it.

17,724. How do you consider that the disease proceeds from one person to another?—I think I ought to have been attacked 50 times by now, but I have had the sputum in the eyes and down my throat and in my ears and everywhere about me.

17,725. Can you explain how the plague extends if neither the rats nor the people carry it?—The household goods do it; everything which is removed from an infected house will carry it.

17,726. I understand it to be your opinion that the best means of stopping plague is to separate the people from the plague poison?—Certainly.

17,727. The plague poison being located in the houses?—Yes, mostly.

17,728. Then it is a good thing to take the people out of their houses?—Yes.

17,729. Having taken them out of their houses you would, I suppose, disinfect the house as thoroughly as you possibly could?—Yes, that is reasonable, of course, though it does not do very much good.

17,730. Do you think that disinfection does not do good?—I will not say that, but is it possible to disinfect, say, a six-storeyed house? I could show you a six-storey house with 2,000 people living in it, and I would be ready to bet the Commission 50 guineas that they cannot disinfect it.

17,731. Having removed the people out of their houses and got them away from the plague poison what further measure would you take with them?—Now, you come to the question which I put before the Medical and Physical Society, that we must divide the places—a big city like Bombay would be first, then a city of 50,000 inhabitants and so on, going down, because the more you go down the more manageable the whole thing becomes.

17,732. Do you consider that the main object should be to get the people away from the infected place and to destroy the infection in the place?—I think the far better plan is not to have the plague at all. I see I have wasted a great deal of my time in the last three years in seeing how we can cure it. Now, I have left off therapeutics and want to confine myself to the question of how to stop it.

17,733. When plague has come, do you think that the best way to stop it is to clear the people out of the infected neighbourhood and to disinfect the houses?—Certainly; doing the best you can to clean up.

17,734. (*The President.*) You think the best thing to do is to protect a town from plague; what would you do in such a place as this to prepare it against plague?—Rebuild it, I suppose, just as we are doing. I believe we are going to show the world an advance in sanitation which neither Glasgow nor Manchester nor Birmingham nor London had. They have only done it in part, and I believe we are going to do it as a whole in this city.

17,735. (*Mr. Cumine.*) You think that running away is the best thing to do?—If you are not immune.

17,736. But people do not begin to run away until a certain number of deaths have occurred and plague has taken hold upon the town; is not that so?—That is so to a certain extent, but feeling acts upon feeling, people

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in a house act upon people in a house, and people in the street upon people in the street.

17,737. Did not the exodus begin after the plague had taken a pretty firm hold upon Bombay and a lot of people had got infected?—Yes.

17,738. So that probably a large number of people who ran away carried the plague with them?—Yes, probably.

17,739. Is not that a very dangerous thing for India at large?—I think we have made too much of that; India at large cannot be attacked. They say there is no history of plague along the valley of the Ganges.

17,740. So much plague as there is in the Bombay Presidency at this moment has all been carried by people running away from Bombay, has it not?—It is probable it is so. 12 years ago I saw the approach of this sanitary calamity—I could not give it the name o plague. I was in the habit of keeping a mortality record for 30 years, and I saw that the mortality of Bombay was going up and up. When I went to the trade districts I found the trade increasing, the godowns increasing, the rats increasing, every abomination increasing, and over-crowding increasing, because the ground was valuable and the place was necessary for the people to get their living. I went to the Corporation and proposed a loan of 60 lakhs of rupees to improve Mandvi. There it is, on the records of the Corporation now. I only lost that by three votes. They said I was the most extravagant man on the Corporation, but if I could have used the word "plague," if I could have said, "Gentlemen, you will be attacked with plague if you do not give that money" I should have got it, and Mandvi would have been a different district, and perhaps none of us would have been sitting here to-day. I saw a sanitary calamity coming into view, but what the name of it should be I could not say.

17,741. I think the word "Jain" is used in a loose sense in Bombay, is it not?—No, not in a loose sense, but in a compound or conjoint sense. A Jain is a man whose religion consists in not destroying animal life, and in that coterie there are the Marwaris and Banniahs—altogether 15 or 16 classes.

17,742. Does not the word "Jain," as used in Bombay, include people who are not of the Jain religion but of the Lingayat religion?—I am not quite sure of that, but the Lingayas are only a population of 3,000.

17,743. These Jains, which you describe as people who will not destroy animal life, are quite a small proportion of the total number of Jains, are they not?—No, I do not think so; I think the registration of 25,000 is correct.

17,744. To explain the figures which you have given you attribute a great deal to diet. But have you made proper allowance for the relative exposures to infection which the European has, for instance, and a Bhatia who lives in Mandvi?—That cannot be shown in a table.

17,745. But in your own mind have you allowed for the difference? There is a great difference in the *chances* of infection, between a European living on Malabar Hill and a Bhatia living in Mandvi, is there not?—Most certainly, and if you take two chawls, one containing 200 people and another containing 50, there is a great difference between them also.

17,746. (*Prof. Wright.*) What steps ought, in your opinion, to be taken to detect plague cases in this city?—I do not think any.

17,747. Do you think doctors ought to be called upon to report plague cases in their practice?—Yes, that is reasonable. We have had that law in force here, and I myself have observed it most rigorously, though I believe I was the only man in Bombay who did so 30 years ago. I have always reported them, even cases of puerperal fever. I think it is quite reasonable.

17,748. Do you think that corpse inspection is reasonable?—I think the Health Officer should have some voice in matters of that kind, because he is held responsible if a serious epidemic arises.

17,749. Do you think that corpse inspection ought to be resorted to in order to detect cases of plague?—Where? That is a very important question. Do you mean at the cemeteries or at the houses?

17,750. At the cemeteries say?—Yes; at the cemeteries you may examine as much as you like. If the Municipality had properly managed the thing, and there had been proper medical men at the cemeteries, the people would never have objected at all; they would have allowed inspection and examination to be made and proper reports of the causes of death. I do not make that statement without the very greatest authority. I was Coroner of this City for 17 years, and, in doing my duty, I have been at these burial and cremation grounds continually, and I have never found the slightest difficulty in finding out everything connected with the case of death there. And that was not because I was Coroner, for my own subordinates could also do it.

17,751. Do you think the patients would give you the right addresses at the cemeteries?—Oh, yes. The police have proved that in their statistics for the last 25 years. We have a double registration here, Were it not for the police and the Municipal registration our figures would be absolutely worthless. At present we look upon the total mortality as correct, and it is correct, and it is correct because the police have to furnish the Commissioner of Police with separate returns every day of every case.

17,752. I understand there is a difficulty experienced in finding out the houses where plague deaths have occurred?—There may be a little in a big city like this.

17,753. Can you see any way of avoiding that difficulty?—I think the Commissioner of Police should tell his sepoys that any increased pay or promotion which they may be looking forward to will be stopped unless the information is obtained. I believe that would stop it immediately. There has been no considerable difficulty with the police in getting all the information which they require, but they were non-professional people and they could not get the causes of death. Here we have to be with a sort of quasi-professional people whom they call Hospital Assistants, and who possibly might be able to diagnose diseases, but they have done nothing; they were hand and glove with the people as far as the statistics seem to show.

17,754. (*Mr. Cumine.*) Can an ordinary coolie tell you the number of the house and the street in Bombay in which he lives?—No.

(Witness withdrew.)

Adjourned till to-morrow.

At The Secretariat, Bombay.

FORTY-SEVENTH DAY.

14th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. Ismail Jan Mahomad.

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MR. ISMAIL JAN MAHOMAD called and examined.

17,755. (*The President.*) You are a Licentiate of Medicine and Surgery?—Yes.

17,756. And you are also a member of the Municipal Corporation?—Yes.

17,757. How long have you been in practice?—This is the 13th year of my practice.

17,758. You have been here all the time of the plague?—Yes.

17,759. What is your opinion as to when the first cases of plague occurred in Bombay?—I think it was about the beginning of August 1896.

17,760. Did you see any cases about that time yourself?—I saw two cases, which I did not diagnose as plague, but which I now think were pneumonic cases of plague. After that I saw two cases with glandular enlargements, and when I saw these cases I communicated with the Health Officer, and told him that I had noticed two cases with high fever, delirium, and enlarged glands in the neck. That was about the 15th or 16th of August 1896.

17,761. You saw two cases before that, you say, which you now think were cases of pneumonic plague. Can you tell us what symptoms those cases had, and why you think now that they were pneumonic cases?—The first of these two cases, of the pneumonic type, was a Multani, who had returned from Nasik. On his return he had fever, and when I saw him his temperature was about 104 degrees, and he was delirious. I examined his lungs, and found no dulness, but there were fine crepitations, and I thought that the symptoms were too severe for a case of broncho-pneumonia, the delirium having come on so soon as that, and being followed by a fatal result within 36 to 40 hours after I had seen him.

17,762. What is the other case?—The other case was also in the same firm—in the same house. He also had been to Nasik, but he did not come back sick. He developed fever after his return here; he was a young man. They sent for me at once, and when I saw him first he had a temperature of 105. In the evening, when I saw him again, he developed the same symptoms of pneumonia, and died within 36 hours.

17,763. Had these cases any relationship with each other?—They were in the same house.

17,764. How long had they been in Bombay?—They had gone from Bombay to Nasik for a pilgrimage. They stayed there for five days, and then returned to Bombay.

17,765. How soon after their return did they die?—One of them returned with fever after his stay at Nasik for five days; and the other developed symptoms of fever after the death of the first. In fact, both the persons died within a week's time.

17,766. What is your view as to the origin of plague here?—When I first saw plague here, I thought that the condition of Mandvi at the time was so filthy, and the houses were so very much overcrowded, that that was the immediate cause of the outbreak. The condition was so filthy that nearly 1,200 cartloads of sewage and filth material were removed from the Mandvi drains at that time. The houses also were very much overcrowded, each room containing five to eight people—a small room of about 10 feet by 16 feet. Although these rooms are well ventilated, still there was very much overcrowding in them.

17,767. Were these rooms in chawls or not?—They were in big houses.

17,768. Not chawls actually?—No, the first cases were in large well-ventilated houses.

17,769. The first cases were the imported cases from Nasik, I understand?—I do not think those were imported cases myself, as I changed my mind afterwards. My first impression was that those two cases were imported cases from Nasik, but subsequently I found out, when I went to this place to treat those Multanis, that there was already a scare among the men in the firm, and many of them were running away from Bombay.

17,770. You said that one of the cases already had fever when he arrived from Nasik?—Yes, but he had left Bombay only five days previously.

17,771. Was there any plague in Nasik at this time?—No, there was no plague at Nasik at all at that time, and plague did not develop in Nasik until last year.

17,772. Will you proceed with your opinion as to the origin?—When I saw those two cases my first impression was that perhaps those cases were imported, but I found out that there was already a scare among those people, and not only that Multanis in that firm, but Multanis in other firms in Bombay, had run away; and I heard that, a fortnight before, there was plague occurring among these people, just about the beginning of August. About six weeks ago I was talking with a resident of Mandvi, and inquiring as to whether anybody had noticed where the dead rats first were found, and I was told that they were found in godowns containing Chinese goods. At that time my attention had not been directed to the fact that there were godowns containing Chinese goods at Mandvi, and I found out that in Argyle Road there were three godowns containing Chinese crackers. These Chinese crackers come from Hong Kong.

17,773. What are the crackers that you refer to—the crackers that you pull or those you eat?—Yes, they are the crackers that you pull. There were also other godowns containing tea and sugar and china silk at Mandvi; and I was told that in one of the sugar godowns dead rats were found.

17,774. That was before these cases you have told us of?—Yes. Curiously enough, on further inquiry I found that these two patients lived in a house which was adjoining one of these godowns; and I found that there was another godown just at the back of this China goods godown; there was a granary, and a number of dead rats were found in that granary, and several plague cases were found in the house on the top of that granary.

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17,775. To what conclusion do these facts lead you?—They lead me to conclude that the poison must have been brought with the goods either in the form of fomites, or, perhaps, a dead rat, which may have infected the rats in that locality; and thus the rats of the locality being infected, they communicated the disease to men. The dwellings in that locality were particularly such as to make these rodents take up their habitations in them; the houses were dirty, and rats made them their hiding places. I believe if a sick rat died in a place where there was a lot of rubbish concealed, the presence of that sick rat dying of plague in that place would communicate the disease to human beings, either through the poison being in the air and thus communicating the pneumonic form of plague, or, perhaps, by the residents walking bare-footed, and getting themselves infected through cuts. I have noticed several cases in which such cuts were the cause of infection.

17,776. You have not told us your opinion as to the manner in which the rats first acquired their infection?—I think it came from either a dead rat or fomites brought in the goods from Hong Kong.

17,777. You think China was the origin?—Yes, I think China was the origin, because particularly at that time, in the month of August, crackers are imported for the Diwali purposes, and also for a Muhammadan festival where crackers are used; and I think Hong Kong has thus a direct communication with Bombay.

17,778. Have you considered the other possible positions from which plague might have been imported?—Yes, I have considered those conditions. It has been said that perhaps it has been imported by Sadhus bringing down the plague from Upper India, and from Nasik. I think there are strong arguments against such a theory. First, as regards Nasik, there was no plague at Nasik at that time at all. We did not hear of plague at Nasik until the next year—the second epidemic—and then, as I said before, there was already a scare among the residents at the time when those two cases occurred, and those residents had never been to Nasik at that time.

17,779. You think the Sadhus have nothing to do with the carrying of plague?—I do not think so, and another thing also is, that if the Sadhus had anything to do with plague, the Sadhus would have communicated it on their way at many other places before they communicated it to Bombay. There was another curious thing about plague at Mandvi, and that is, that for about a month or so plague was confined to a particular locality of Mandvi, just below the Masjid Bridge, showing that the poison was there among the rats in that locality. Now that locality is separated from the other locality by a big railway line, and for one month not a single case occurred, till people were allowed to remove from that place and go and live in the centre of the crowded locality of Mandvi. I believe that in that way it was spread both through rats, as well as through human intercourse, to other places. I noticed in two cases that people suffering from plague, who were living at Mandvi, were taken to Khetwadi. There was not a single case of plague up to that time there. When these two persons were taken there, they died. After their death, for some time no case of plague occurred, but, 15 to 20 days afterwards, dead rats were found in the locality; and after the appearance of dead rats, plague spread; so that I believe that in that case plague was first conveyed from Mandvi to Khetwadi by these two people being carried there. They infected the soil there, and rats were infected from that. Similarly at a village of Versova, where I used to live before, a case was taken there and concealed. He died there, but nothing of plague was heard there for about 20 days, when dead rats were found, and after that plague broke out. I think, therefore, that plague is conveyed from one place to another by human intercourse: first, a plague case is carried there, that infects the soil, and then rats are infected. I believe rats have a good deal to do with the spread of plague.

17,780. In regard to the infection, how do you think that enters the human body?—I think one of the modes is through cuts—direct inoculation—and I have noticed several plague cases where there was a small cut on the foot. The pneumonic form of plague is generally acquired through the air. I have noticed in some cases attendants getting it. In the case of Dr. Manser, and also of some of my private patients I have noticed that.

17,781. Where it is produced by breathing an infected atmosphere?—Yes.

17,782. In those cases where you have observed a lesion of the feet, or of a foot, on which side, and where, did the bubo occur?—I have not particularly marked it, but my impression is that it was generally on the right foot.

17,783. If the lesion was on the right foot, where would the bubo be generally?—On the right side.

17,784. The bubo was generally on the same side as the lesion?—Yes.

17,785. Have you any instance in which a pneumonic case appeared to have been produced from a bubonic case?—I have not particularly noticed such a case, but I believe it to be quite possible.

17,786. You have no facts?—No.

17,787. Have you any instance in which a bubonic case has been produced from a pneumonic case?—I cannot produce any facts.

17,788. You have facts which show you that pneumonic cases may be produced from pneumonic cases?—That I do say.

17,789. Have you facts which show you that bubonic cases may originate from bubonic cases?—I do not think that the mere remaining with a bubonic patient would give rise to a bubonic case. I do not think that plague with a bubo is communicated through the atmosphere.

17,790. There is no immediate communication?—No.

17,791. It must be communicated through the soil to the person who is infected, you think?—Yes.

17,792. Have you had much experience of Haffkine's prophylactic fluid?—Yes, I have.

17,793. Please to state generally the results of your experience?—In my dispensary, about 996 people were inoculated by my partner with Haffkine's fluid. I have done several. I have the records of these here, and I know the after history of most of them. Out of these 996 cases, there were 39 cases where the inoculation was done before the age of five years, there were 10 cases in which inoculation was done after the age of 60 years, and there were 947 cases in which inoculation was done between 15 and 60. There were three cases in which plague developed after inoculation. In one case plague occurred two days after inoculation, in another it occurred 29 days after inoculation, and in the third case it occurred 18 days after inoculation. The one who got plague two days after inoculation recovered, the other two died; but inoculations were performed in such a class of patients that I believe if it had not been for inoculation, many of these 996 cases would have succumbed of plague.

17,794. Were these cases selected in any way?—No; those who used to come to our dispensary were inoculated.

17,795. They came voluntarily?—Yes.

17,796. Do they represent the very lowest, or the middle, or the higher classes?—From the lowest to the highest; all classes.

17,797. Many of them lived, therefore, in the worst sanitary conditions?—Yes.

17,798. And others in good sanitary conditions?—Yes. In addition to the inoculations in our own dispensary, of my own community about one-half were inoculated at H. H. Aga Khan's bungalow, Khushroo Lodge. Still, I used to take a great deal of interest in knowing the after results of these, and I have collected all the figures of the inoculated, the number of cases in those inoculated once, and the number of cases in those inoculated twice. I have got them here, and I will present them to the Commission.* Professor Haffkine has submitted his report† about the first period of inoculation from 20th December 1897 up to the 20th April 1898. I have tried to verify all the results given in that report, and I find that the names of the people inoculated, and the results, are all perfectly correct. After that date, that is from the 20th of April 1898 to December the 21st, 1898, about which M. Haffkine has not submitted a report, I have

* *See* App. No. LV. in this Volume. A report by Dr. Khaja Abdulla regarding cases of persons treated in the Khoja Hospital, Bombay, with a list of inoculated cases, is published as App. No. LV. (1) in this Volume.

† *See* App. No. IV. in Vol. I. of the Commission's Proceedings.

tried to collect the figures, and I am glad to say that the results are more encouraging than for the previous period.

17,799. How many cases were inoculated in this last period which you speak of?—About 5,000 are inoculated, and the other 5,000 are not inoculated.

17,800. What other 5,000?—The Khoja community consists of about 10,000 people.

17,801. There was no selection made for inoculation, was there?—There was no selection, and I think that the Khoja community presents an aspect about inoculation which ought to be instructive for others. In fact, among the Khojas, 90 per cent. of them live at Mandvi, the place where plague first began. Many of this 90 per cent. are middle-class Khojas living in overcrowded chawls and houses, most of them living under the same circumstances, and often in a family some of them are inoculated, and some of them are not inoculated. There are instances of inoculated and uninoculated persons living under the same roof, and under the same circumstances, in which those who were inoculated escaped being attacked with plague, and those who were not inoculated got plague. In the case of my brother's son, who was not inoculated, he got plague, while the others, who were inoculated, all escaped.

17,802. How many others?—Nine.

17,803. Living in the same house?—Yes. I can point out many other instances of that in the Khoja community, in which people living under the same roof, and under the same circumstances and conditions of life, escaped among the inoculated, while those not inoculated got plague. There are two instances which I specially want to bring to your attention. The first is that of a boy of about eight years of age. He got plague a week after he was inoculated a second time. He had a big bubo in the groin, and when I saw him his temperature was 105. I inquired of the parents whether there were any cases of plague in the house, and the answer was that this second inoculation was done because dead rats were found in the house.

17,804. How long after the first inoculation was the second inoculation performed?—It was about 10 or 12 months after the first inoculation. The second inoculation was done because dead rats were found in that house. On farther inquiry I found that there was another man who was suffering from plague in the same house. This boy, who was inoculated, recovered; the man who had plague, and was not inoculated, died. Now, this first boy, who was inoculated, and who got plague, recovered. It was a genuine case of plague—I do think his recovery was due to inoculation, and I believe, if he had not been inoculated in time after the dead rats appeared, that, perhaps, he also would have died. There was another similar case in which symptoms of plague developed after the first inoculation, and in which case also the inoculation was done because dead rats were found. This case also recovered, but I believe, if he had not been inoculated in time, that, perhaps, he would have been the worse for it. As to the second period of inoculation among the 5,000 Khojas, I have calculated that out of the 5,000 that were inoculated between the period of April the 21st, 1898, to December 21st, 1898, there were 22 cases of persons who were inoculated, who got plague, and died of it, and there were 26 cases of persons who were inoculated, and who died of other diseases. There were 218 of the non-inoculated who died of other diseases, and there were 44 of the non-inoculated who died of plague.

17,805. In addition to the 218?—Yes. Now, the average mortality among the Khoja community, taking the average of five normal years, is 342, about one death a day; and the average normal mortality for the eight months that I have selected for my calculation would be about 240. Now, I have said about half the community were inoculated, and half not inoculated. 5,000 were inoculated, and 5,000 were not inoculated, so if there is a normal mortality, then we would have 115 deaths in the inoculated persons from ordinary causes in ordinary times. Instead of that, we have got only 48 deaths, so that we get a mortality even lower than the normal mortality.

17,806. That is less than half?—Yes. Now let us take the uninoculated. We have got among the uninoculated a mortality of 218 and 44, a total of 262. Instead of 115 we get 262 there. I have tried to verify these figures from our jamaat books. Our community has a record kept, in which the name of every person dying is given, because the community gets a certain amount of fees for every death, so that the figure for total mortality which I have given here of all the four, 310, is a figure which is quite correct. I have taken it from the books of the jamaat or community. Now, as regards the figures I have given you of people suffering from plague after inoculation, 22, that is approximate; but I think that there are actually less deaths from plague among the inoculated than the figure that I have given you. When I say that, I say it for this reason, that up to this time in the jamaat book there is a record of only four cases of the inoculated dying from plague. I have put it down as 22, because, from my investigation, I found that there were some cases which were put down as brain fever by the practitioners, which were actually cases of plague, so I have added to the original figure 4 18 more of suspicious deaths after inoculation, and so have brought the figure up to 22, but I believe, if careful notification was made, the number of plague cases after inoculation would be even less than 22. In the figure of 218, which I have given of persons dying from other diseases among the non-inoculated, I can find among those many cases of people who have died of plague, but who have not been returned as dying of plague, but from other diseases—as many as 90 out of those 218. If we take all cases of brain fever, and some cases of phthisis, then I think that as many as 90 may be deducted from those as having died from plague. I am now carrying on my investigations in verifying these figures, and I want to bring them out just when Professor Haffkine brings his own figures out.

17,807. So that you think the number of plague cases was erroneously increased by wrong entries?—Yes.

17,808. How do you account for this remarkable difference in the mortality from causes other than plague in the non-inoculated, as contrasted with the inoculated?—I think the non-inoculated death rate has increased in comparison to the inoculated, because several weak people do not get inoculated, and inoculation is not done in very young children, in whom there is a heavy mortality.

17,809. There is a high mortality in the very young?—Yes, at present there is a great mortality in the young children, and that may account for the large majority; but I think there is some protective property in inoculation against other diseases also. I have not noticed up to this time in my community any complaints about the after effects of inoculation. I have found in some cases, where reaction was strong, that people suffered from loss of appetite and weakness, but after a time it passed off. I lately had a case where I re-inoculated a maid servant in a family. She would not undergo inoculation last year. She was suffering from a severe headache for many years. Curiously enough three or four days after inoculation the headache entirely disappeared.

17,810. Has she remained free?—Yes, I inquired yesterday, and it is quite gone.

17,811. What other affections do you think are benefited by inoculation?—I have no facts with regard to that; but my impression from the figures is that it has some effect.

17,812. You think the mere exclusion of the very old and the very young will not chiefly account for it?—I do not think it would entirely account for it.

17,813. Can you give us the ages of the 5,000 who were inoculated in this community, and of those who were not inoculated?—They are not absolutely correct figures. There may have been 200 more or less. Our census is also not very accurate, but I believe that 10,000 is a fairly correct figure.

17,814. In the case of the 5,000 who came directly under your notice, can you give us the age of each of those who were inoculated?—I do not think I can give the age.

17,815. What ages did you exclude in inoculation as a general rule?—When I was practising inoculation, I used to avoid persons who were very weak in constitution, whatever age they might be. I would inoculate an old man of 60 or 65 if he had a good constitution.

17,816. I thought you placed importance on the fact of the young and the very old being excluded, in accounting for the higher mortality in the non-inoculated?—I excluded a great many, and others also, perhaps, remained away themselves.

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17,817. You inoculated all who presented themselves if you found them sufficiently strong?—Yes.

17,818. Age was not a barrier?—No.

17,819. That was your experience of a part of the 5,000; what was your experience of the remainder of the 5,000?—The remainder of the 5,000 were not inoculated.

17,820. I mean those that you did not yourself inoculate?—I have not inoculated these 5,000. Those were all inoculated at H. H. Aga Khan's bungalow at Khushroo Lodge. I have been among these people from the beginning, and I have been getting out of the jamaat books how many persons were inoculated, how many were not inoculated, and how many died after inoculation, and so on.

17,821. Will not these books show you also their ages, and when they were inoculated?—No.

17,822. Was there no distinction between an infant and a grown up person?—No.

17,823. Have you had any experience with regard to the curative treatment of plague?—Dr. Yersin was requested by me to see a case at the Connaught Road Khoja Hospital of a patient who was picked up in the road. Dr. Yersin saw the patient, and he pronounced the opinion that the case was very bad, and he would not inoculate the curative serum. I showed him another patient who was admitted that very evening, and he inoculated that patient, and the inoculation was continued for three days successively. On the fourth day the fever of this patient who was inoculated with Dr. Yersin's curative serum was less, and the patient was on his way to recovery. At the same time the other patient, whom Dr. Yersin refused to inject, was also getting on well.

17,824. That was the patient whose symptoms were apparently more severe?—Yes.

17,825. Have you any other experience?—Yes, I have two other cases that I placed under Dr. Yersin, in the Khoja Hospital, but unfortunately they both got bad and died.

17,826. Was much serum injected?—Yes, each of them had serum injected every day for three days, morning and evening.

17,827. In what day of the illness was the treatment commenced?—One of these two cases was on the first day; the other case was on the second or third day of of the illness. I have noticed four other cases under Dr. Yersin. They were not my cases, they were in a neighbouring hospital. There were five cases altogether—four died and one recovered.

17,828. Was your experience satisfactory or unsatisfactory?—My experience was unsatisfactory.

17,829. You made some reference to insanitary conditions not being accountable for the production of plague. How far do they affect or increase the virulence of plague, assuming it has been introduced into a locality?—I think insanitary conditions conduce to make the plague more virulent, and cases would end fatally. There would be no chance of recovery for people suffering from plague, and living in insanitary houses.

17,830. As to the influence of insanitary conditions on the amount of plague, what do you think of that?—I think that with insanitary conditions plague will certainly increase.

17,831. Have you any facts which will bear out that opinion?—I know of several houses in which one case of plague has occurred, and because the house was not in a sanitary condition the whole number of the people living there—they did not vacate the house—became victims of plague, and died.

17,832. Is it your opinion that people living in insanitary houses are more easily affected?—Yes.

17,833. You said that the plague appears to be very virulent in such houses, or, at least, that the chance of the recovery is less?—Yes.

17,834. As to the localities in this city in which plague has been most prevalent, have you been able to trace any relationship between that prevalence and the sanitary conditions?—As I said before, both Mandvi and Kamatipura are known as the haunts of plague. In Mandvi there are big and well-ventilated houses, but the sanitary condition as regards the drains is very bad, and there is overcrowding in the houses. As regards Kamatipura, the houses are all low, the ventilation is not good, and there is overcrowding there, too.

17,835. These, you say, have been the chief haunts of plague?—Yes.

17,836. Are these the most insanitary quarters of Bombay, or not?—Kamatipura is the most insanitary quarter of Bombay. Mandvi is not so insanitary: but I think Mandvi remains the haunt of plague for some other reason.

17,837. What other reason?—One reason is because the granaries are there, where there are a number of rats. I believe if there was a single house which contained infection, as soon as there is a colony of new rats, they get themselves infected, and spread the plague. After the plague has been over the place, and all the rats are dead, for the time being the plague subsides. Then there comes a fresh colony of rats.

17,838. A fresh importation?—Yes, and they get themselves infected, and plague spreads.

17,839. Have you anything to say with regard to curative serums?—I treated one case with Dr. Lustig's serum. In that case the effect was very good. The patient, a Khoja lad, suffered from fever and a bubo in the groin. I saw the patient. I found he had eczema on the legs, and I thought the enlargement of the gland was due to that. I treated him for one or two days, and he got well. After a month he again got fever, his temperature going up to 105 degrees. He had a small gland just on the side of the chest. On this occasion there was no eczema, or anything to account for the gland. As this patient had been visiting another plague patient, I had grounds for believing that the lad had plague, and I immediately sent for Dr. Galeotti. Dr. Galeotti's Assistant, Dr. Polerini, came and injected the serum. He gave no other treatment, except injecting the serum. For three days the lad had fever.

17,840. Was the serum injected twice a day?—Yes, twice a day. The fever subsided on the third day. Then, again, after three or four days the fever increased, and the bubo suppurated. Then it was opened, and a big characteristic slough of plague gland came away. I think this was a typical case of plague, and that the cure was due to Professor Lustig's serum.

17,841. Was that the only case in which you used Dr. Galeotti's serum?—Yes.

17,842. I understand that in the other cases Yersin's serum was used?—Yes.

17,843. (*Mr. Hewett.*) Among the uninoculated who died, I see as many as 47 were under one year of age?—Yes.

17,844. Whereas among the inoculated who died there were only two?—I have not calculated the figures.

17,845. I shall be glad if you will give me the following information:—1st, the number of inoculated that died under one year of age; 2ndly, the number of uninoculated that died under one year of age; 3rdly, the number of inoculated who died between the ages of one and five; 4thly, the number of uninoculated who died between the ages of one and five; 5thly, the inoculated who died being over 60 and under 70; 6thly, the uninoculated who died being over 60 and under 70; 7thly, the inoculated over 70 who died; and, 8thly, the uninoculated over 70 who died?—The following figures show the number of deaths in the Khoja community at different ages amongst the inoculated and uninoculated. The number of deaths of children inoculated under the age of one year is one only: the number of deaths among children below one year not inoculated is 57. The number of deaths amongst children inoculated between 1 and 5 years is 7; and amongst the non-inoculated between 1 and 5 years is 33. The number of deaths amongst the inoculated between 60 and 70 is 2 only, and amongst the uninoculated 28. The number of deaths amongst the inoculated over 70 years is 2, and amongst the uninoculated 8 only. The above figures show what advantage the inoculated have over the uninoculated at different ages. It would be interesting to know how many were inoculated at the different ages, but unfortunately the jamaat has not got such a record, but I suppose Prof. Haffkine must have got such a register.

17,846. (*Mr. Cumine.*) You gave us two sets of figures; one set you got from the Jamaat book: where did you get the other set from?—I got the other figures after verifying some of the cases myself. I went and

made inquiries in the families, and I found that several of those who were reported to have died of other diseases, actually died of plague.

17,847. Were you ever supplied with a register of the names of all the people who had been inoculated?—No.

17,848. In going through the jamaat books, how did you know, as regards each death entered, whether the person was inoculated or not?—Since inoculation has been introduced great care has been taken in inquiring whether a particular man who has died was inoculated or not, and how many times he was inoculated.

17,849. But you did not test to any extent the correctness of the entries in the jamaat book—you had no register of inoculated persons to refer to?—I had no register; but by visiting the families, and making inquiries, I was able to find out whether a particular person mentioned in the book had been inoculated or not.

17,850. But supposing an inoculated person had died, and his death had never been put down in the jamaat book at all, how would you have known of it?—It is impossible that a death could not be put down. The jamaat book is most accurate.

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17,851. Did you keep any note of how many persons there were in each of those houses so visited: how many persons were inoculated, and how many uninoculated; and how many attacks and deaths there were amongst the inoculated and uninoculated respectively in each house?—I have not got a register of that.

17,852. (*Mr. Hewett.*) Did you attend a man named Narayan Mulji for plague?—I attended Narayan Mulji for axillary abscess, not plague.

17,853. Did he have more than one attack of plague?—He did not suffer from plague at all.

17,854. Please give date and details?—The axillary abscess was opened in 1896, this had left a sinus which suppurated after a couple of months and was opened again.

17,855. What was the position of the buboes in each attack?—The abscess reformed in the same axilla.

(Witness withdrew.)

Mr. GEORGE LUND called and examined.

Mr. G. Lund.

17,856. (*The President.*) I believe you are a merchant?—I am in business in Bombay.

17,857. Have you had much to do with plague measures?—Yes, a great deal, for more than twelve months, day by day.

17,858. (*Mr. Hewett.*) Would you specify the districts in which you have been working as a volunteer?—I have been working in the Mazagaon and Tarwadi districts, more particularly just recently in the latter.

17,859. What is the character of the population in those districts?—Principally Ghatis. The population at the last census was close on 55,000: at the present moment it undoubtedly is considerably in excess of that number. In the southern portion, the people are principally Ghatis by caste, labourers and cartmen, living from hand to mouth, and employed in the docks and Mandvi; there are also Portuguese and some fisher folk. In the northern part there are cartmen and mill hands, with several large colonies of Parsees and Muhammadans located here and there all over the districts.

17,860. Is the district a very congested one?—Some parts of it are very congested, particularly at the present time.

17,861. What was the state of the public sanitation when the plague broke out?—The public sanitation was, and is at the present time, not at all good. It is most unsatisfactory, owing to a considerable portion of the district being at so low a level that lifting must be had recourse to to deliver the sewage at the outfall at Mahalakhshmi. The necessary works are now being vigorously pressed on, but it will be some time yet before they can be completed. At the present time the sullage water passes into the side drains, many of which are in a very worn and offensive condition. This, I consider, to be one of the great objections and difficulties in the neighbourhood. The night soil is collected into carts and discharged into a drain for outflow into the harbour, causing a great public nuisance. The domestic sanitation of the district is on the latrine and basket system. Many of the latrines are ill-ventilated and in a very unsanitary condition. The Health Department of the Municipality do all they can to remedy the evil, but owing to the apathy of the landlords, and the unwillingness of Magistrates to inflict adequate fines, the nuisance in a great measure remains unabated. There was one case in which a landlord was had up before a Magistrate for the third time on account of an overflow of a most objectionable character from latrines. He was only fined two rupees. He can go on paying two rupees as long as ever he likes. It is cheaper to pay fines than to make alterations.

17,862. Did you experience any difficulty at any period of the operations in ascertaining the number of plague cases?—We have always found more or less difficulty, particularly under the Plague Committee; they were secreted very considerably under the Plague Committee.

17,863. To what do you attribute this difficulty?—To the harshness of the measures carried out. In a city like Bombay, with a large population, the more rigorously you try to enforce your restrictive measures, the less, I think, you will succeed.

17,864. Can you give us any definite instance in which the effect of these measures was to cause people to disappear?—Yes. On the Port Trust Reclamation on the Reay Road people were hidden in stacks of wood. One Sunday morning we found four people hidden in that way. Stacks had been built up, and big balks of timber and trunks of trees had been moved, and the people covered in so that we should not find them. I may cite one instance on the Telang property. There was a large block of chawls there. I asked whether I might be allowed to vacate it in my own way. The Plague Committee said no, a regular authority had been provided, and it must be done by them. I said, "Very well." The result was that the soldiers and sailors arrived, the building was surrounded, and when we went inside, the whole of the inhabitants, numbering about 300, had entirely disappeared, except two men who were suffering from plague right up at the top of the house. One died before he could be removed, and the other died shortly afterwards.

17,865. Is the objection of the people to the removal of the sick, or to the segregation of the healthy?—It is going to the hospital. They do not like it. It was in consequence of that, that in conjunction with some other gentlemen who kindly assisted me, we started a hospital for this Telang property in which we treated patients. Profiting by the experience gained in the previous year in the attempt at segregation in the Telang property, which consists of six large blocks, a local hospital was established for the use of the inmates. Thirty-seven patients in all were treated in the six weeks it was necessary to keep it open. I consider at the present time, with the building ventilated so much, that there is no indigenous plague in the chawl. We have had some few cases from time to time, but they have been people who have contracted the disease outside. They have probably contracted the disease while at work. They have come home and have been so sick that they have not been able to go to their work any more, and have died in the place. The reason why I do not think there is any plague in the chawl is because the women do not get it, it is almost exclusively confined to the men who are employed in work. As I have already said, 37 patients in all were treated in the six weeks it was necessary to keep this local hospital open. Of 22 cases of relapsing fever and other diseases, one sufferer died, the others all recovered. Those who, from poverty and the consequent necessity of continuing their daily labour till the last possible moment, were not discovered till it was too late for treatment to be of any avail, died. Large numbers of houses and buildings in the district have been reported to the Municipal Executive as insanitary, and many of these have been condemned and destroyed.

17,866. Do you think that you now get the majority of cases reported to you?—We get more than we did, but at the same time there are a good many cases everywhere being secreted.

17,867. Is it your experience that the majority of cases are reported to you when the people are still sick, or

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after they are dead?—We get a great many sick cases reported to us, I think I may say that the majority of cases are reported to us before they are dead.

17,868. That is an improvement?—Yes, with regard to my own district, I certainly think there is a decided improvement.

17,869. Have you, in your district, resorted to the practice of treating sick persons in their own houses?—Not many in my own immediate district. It was done, however, by Mr. Firth in the "E." ward on the other side of the Parel Road. We have treated two or three cases in that way, but not to the extent that Mr. Firth has done.

17,870. Have you had an opportunity of observing its effect in Mr. Firth's district?—In not one of the cases has the disease spread, nor has it spread in my own district. At the present time I have one such case in the Telang property, and the people immediately in contact with the case have not been infected at all.

17,871. Have you disinfected the house in which you have allowed this patient to reside?—We disinfected each floor before the recrudescence began. We have opened out holes through the floors from top to bottom.

17,872. Did you take any other measures?—We inoculated all the people in the same room with this man, and we cautioned the other people not to go into the other room. We told them that if they did go there we should be obliged to send them to camp, and as far as we can judge I do not think the people have gone there. We have, from time to time, gone there unexpectedly, but we have never found more than the two attendants with him.

17,873. Have you disinfected the house since the case occurred?—No; we shall do that afterwards. We use disinfectants, however, in the room at the present time.

17,874. In a case like that, when you allow a sick person to remain in the house, would it be possible to disinfect the remainder of the house?—Certainly.

17,875. But you have not done so?—No, because I do not think it is necessary. The plague is not in the house. The man did not contract the plague there; he got it when he was at his work at Mandvi.

17,876. The only room in this particular house which you regard as infected is the room in which the patient is residing?—Yes. We shall disinfect that room, and the other room next to it. If we have another case we shall disinfect the whole floor. When, however, there is only one single case we merely disinfect the room itself, and the rooms immediately in contact.

17,877. I believe you have had some experience with regard to inoculation?—I have.

17,878. Would you give us the facts that have come under your notice?—Inoculation has been encouraged in every way. Contacts are given the option of being inoculated or going to camp, and opportunity is taken of a clear or doubtful case of plague occurring in a building, to persuade as many inmates as possible to submit themselves to the prophylactic. Of the total number of persons inoculated by the medical officers in the district, and at their dispensaries, up to date—close on 7,000, whose names and addresses are known and noted in the office books—one death only from plague has occurred, and one of complication—in the Telang property—high fever, vomiting and purging, which was successfully treated in the local hospital. In one chawl in Victoria Road 103 persons were inoculated. Since I sent in my report 48 more have been inoculated. In Love Lane, 25 were inoculated, and since my report 43 more. In Chudda Chawl, 167 were inoculated, and on Sunday morning we inoculated 75 more. A case occurred, and the people came forward voluntarily to be inoculated. In Hyderali's Chawl, 86 were inoculated, and 14 have been inoculated since. In Contractor's Chawl, 50 were inoculated. In Jarawalla Chawl, 100 were inoculated. A case occurred there, and this morning 24 people came forward to be inoculated. The room in which the case occurred is now being disinfected, the patient has been sent to hospital. In the Telang property, at the time of sending in my report, 300 were inoculated, but more have been done since. The figures I have just given for the chawls make a grand total of 1035. With regard to this I may mention a very sad fact. Dr. Pithari has since died of plague. He was a gentleman who for many months quite gratuitously devoted his time to the discovery of plague cases. He performed a very large number of inoculations, but unfortunately he did not inoculate himself. He got the pneumonic form of plague. He was taken ill on Sunday, and on Wednesday he was dead, poor fellow. It is very sad.

17,879. You have had, I suppose, a favourable opportunity of observing what has happened to these people who have been inoculated?—I have.

17,880. Have you noticed any case of plague amongst them?—Only one. That was the case of a man who died on the 26th of last month. He was inoculated in September last. That is the only person who has come under my notice as having died.

17,881. Have any cases come to your notice in which uninoculated people residing in the same house with inoculated persons had plague, while the inoculated persons have escaped?—Yes, there was a case this morning.

17,882. Will you state it?—It happened in Jarawalla Chawl. A woman got plague, but the other people who were inoculated did not get it.

17,883. Could you give us the number?—It was only a question of three or four in that one room.

17,884. They have escaped so far?—They have.

17,885. Were you able to ascertain how the woman got plague?—No.

17,886. During the course of the operations you have engaged in, have you resorted to corpse inspection?—No, and I should not approve of it. It would be so objectionable to all the people, particularly Muhammadans, that I should not think it would be advisable to press it. I think the present mode of finding out deaths is all that is necessary.

17,887. From your experience, do you think that corpse inspection would assist materially in finding out plague cases?—I do not think it would. If I might express an opinion, I think that dealing with plague, in a large city like Bombay, is like ploughing the sand. One can, after all, only do one's very best, and trust to Providence for the result. That is my experience. It is possible that more actual plague cases would be identified, but I think the effect upon the people would be very objectionable. It would have a very disturbing effect. The quieter you keep the people the better.

17,888. Have you formed any opinion as to the relative malignity of the three outbreaks in Bombay?—The present outbreak is in many cases of a most virulent type. I have known two or three cases in which the people have come home from their work in the evening and have been dead by the morning. There is a great deal of pneumonic type; but I ascribe a great deal of it to the excessively cold weather we have had, and its long continuance, and the different conditions under which many people live. In my own immediate district, where I will not allow obstructions to be made to the free ventilation of air through the rooms in which the people sleep, I insist upon the place being kept open. I think that has something to do with the virulence of the attack, as far as the pneumonic form is concerned. I am not a medical man, and I speak with diffidence upon the subject; but I do think that the excessively cold weather we have had, and the different conditions under which the people live, have led them to get this pneumonic type of plague.

17,889. Have you noticed any instance in which people in the same house have suffered, one from bubonic and another from pneumonic plague?—Yes. In the Telang property we had cases of both. In Dr. Pithari's case he had both; he had the pneumonic form, and buboes as well.

17,890. Have you, in the Telang property, observed any instance in which a person has apparently caught pneumonic plague plague from a case of bubonic plague, or *vice versâ*?—That I could not say.

17,891. Can you give us any facts which will show the connection of rats with the diffusion of plague?—No, I do not know that I can, except that in Hyderali's Chawl a number of rats died, and we took the precaution of getting the people to take all their belongings out into the compound, or on to the verandahs and other places while we disinfected every room. I consider in that way we prevented a large recrudescence of the plague. We have had one or two cases, but very few; otherwise one might have expected a great many, for there is no doubt that rats do convey the contagion, because where there is contagion dead rats are frequently found. Where we have had a case of death from plague, and

we turned out the people's belongings, their old rags, and pots and kettles, of which they accumulate a very large number, we have frequently found sick and dead rats.

17,892. (*Mr. Cumine.*) Do you know of any case where a certain number of people have been inoculated, and a certain number uninoculated, and an inoculated person has been attacked and the uninoculated persons have escaped?—In the Khudda Chawl a man died last month who had been inoculated, but the other people who had not been inoculated also got the plague.

17,893. Then you do not know of a case?—No.

17,894. When you disinfect a room, do you disinfect it only once, or do you keep on doing it for a week?—In a fatal or a very bad case of plague, we disinfect the room for seven consecutive days.

17,895. That is what Mr. Firth does?—Yes. Those are the orders, which we carry out. *Mr. G. Lund.*

17,896. (*The President.*) What is the present method of the notification of the causes of death?—We get notices from the police; they give notice to our office. 14 Feb. 1899.

17,897. How do they obtain the information?—It is information received.

17,898. It does not come through any medical source?—It does sometimes, but not always. If a medical man has a case of plague he notifies it to us or the district in which it occurs.

17,899. In the majority of cases the information comes direct from the police?—We discover a great many cases ourselves; on the other had, we get information of a good many cases from the police as well; sometimes more from one source, and sometimes more from another.

(Witness withdrew.)

Mr. N. N. KATRAK called and examined. *Mr. N. N. Katrak.*

17,900. (*The President.*) You are Licentiate of Medicine and Surgery of the Bombay University and a member of the Municipal Corporation?—Yes.

17,901. You have watched the progress of plague in Bombay for some time?—Yes.

17,902. Since the first epidemic?—Yes.

17,903. And you have also watched the effects of treatment and prevention?—Yes.

17,904. You have observed the influence of the prophylactic fluid on the spread of plague, have you not?—Yes.

17,905. Have you any statistics to give us upon that subject?—I have statistics so far as the cases I have inoculated are concerned, but my conclusions have been formed more from the statistics which are laid before the public and it is that which has led me to come to the conclusion that inoculation is a good prophylactic and preventive against plague.

17,906. The conjoint evidence?—Yes.

17,907. How far does your own evidence lead you to that conclusion?—I have inoculated about 500 people, and all these cases have escaped plague except one, who developed plague symptoms within one hour after the inoculation.

17,908. Have you seen any bad effects following inoculation?—None in the 500 which I have done, and I have carefully inquired into the whole matter. So far as my inquiries go I do not think there is much truth in the complaints made from time to time. I should like to say that when we in Bombay read about the evidence of Dr. Lawrie and Dr. Johnston that the plague prophylactic was a putrescent fluid, as I had taken the great interest in the matter, and as I had found no unpleasant effects in any of my cases, I thought there must be some misunderstanding on the point. With that view I opened a certain number of bottles and re-sealed them with a view of seeing if exposure to the atmosphere had an influence in making the liquid putrescent.

17,909. How long did you leave them unclosed?—About 20 minutes. I could give the results of the examinations made by Prof. Haffkine, Dr. Milne, and Dr. Rau.

17,910. Those bottles which you refer to were examined by bacteriologists?—Yes. The results were that two whole bottles which were never opened were found to be sterile. In one bottle which I have mentioned the seal was not intact, and I had some doubt about its purity, and therefore I did not use it for a long time; it was kept in a corner. When Dr. Lawrie's evidence came before us I forwarded that bottle to Dr. Rau, and even that suspicious bottle was found to be sterile. Of the bottles which were opened by me and re-sealed, only two were found to be contaminated, but in one of these the sealing or the re-sealing was unsatisfactory to me, because the cork re-bounded and the seal was again broken. I made a note in that connection even before the bottles were sent to Dr. Rau, that the sealing was not satisfactory. With regard to the other contaminated bottle described by Dr. Milne, I did not take notes, because I had no idea of bringing the matter before the Commission. I have a dozen bottles which have been opened and re-sealed which the Commission can see if they wish.

17,911. Have you examined their contents?—No. They have simply been opened and re-sealed with the dates, numbers and so on marked on them. I have brought them for the use of the Commission.

17,912. Have you seen any good effects outside of the influence of the prophylactic upon plague?—Yes, I have particulars of some cases. The first case was that of a Parsee boy aged 15. He was inoculated during the second epidemic, and a few days afterwards he got plague. He was inoculated with a third of the dose because he wanted to go through three inoculations. He recovered of the plague and since then he felt a sense of chilliness for nearly 6 months or perhaps more. Then he got one inoculation. After that inoculation the sense of chilliness disappeared. After his first inoculation he got plague; he then passed that epidemic and the intervening portion, and during the last recrudescence he got himself inoculated again. Since then that sense of chilliness has disappeared.

17,913. What do you infer from that?—This is one instance in which it has done some good.

17,914. Are you quite sure that the first inoculation did not produce the sense of chilliness which you refer to?—After the first inoculation he went through the whole course of the plague, and a very severe one too.

17,915. That first inoculation might have been the cause of the chilliness?—It is for you to draw conclusions: these are the facts.

17,916. Have you any other facts?—Yes. There was a lady aged about 46 who had a sort of chronic fever lasting for many years This chilliness she got rid of after the first inoculation which was done on the 8th October 1898. Then I have another case of a young man aged 30 who had severe lumbago and a severe pain in the sacral joint. He was treated with blisters and applications, and was relieved temporarily from time to time. He was inoculated during the second epidemic and since that time he is free from the pain. This year he came to me to be inoculated, not as a preventive against plague, but as a preventive against the disease, which he believed would start in this cold season. He got inoculated on the 28th October, and he is still free from pain.

17,917. You have further cases of a similar nature?—Yes.

17,918. You have paid a good deal of attention, as a member of the Corporation, to the measures to be adopted during epidemics of plague?—Yes.

17,919. To what extent do you think insanitary conditions are accountable for the virulence or extension of plague?—My idea about the insanitary condition is that when a person gets the infection he succumbs to it more easily if he is exposed to insanitary conditions. If the sanitary conditions round about him are of a healthy nature, then the percentage of succumbing would be less and perhaps the virulence would be less also. I base my opinion first of all on the observations that I have made and which anybody can make, and also on some experiments made by Alessi which I have quoted in my précis.

17,920. Will you give us the quotation which you refer to?—He took a certain number of animals and put them in a cage and had the cage connected with the drain pipe. Other control animals were placed in

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ordinary conditions. After exposing them a certain time to the influence of the sewer gas the animals were inoculated with pathogenic germs as well as the control animals, with the result that a greater number of those who were exposed to the influence of the sewer gas succumbed. In fact, they first of all got the disease and succumbed in a large number, whereas those other control animals who were not under the influence of sewer gas succumbed in a smaller number, and also had a lower mortality.

17,921. You would include the removal of insanitary conditions among the measures which are the most important?—Yes, of the greatest importance.

17,922. Have you any experience with regard to disinfection in connection with plague?—I have, in my capacity as an official visitor.

17,923. What is the result of your experience?—My idea is that disinfection is possible, and also very efficacious.

17,924. You think it should be included among the measures?—Certainly.

17,925. With regard to the propagation of the disease, what do you find is the influence of rats?—Men as well as rats propagate the disease, but man is a much less important factor in that respect than rats. My observations are that a man cannot communicate the disease to the healthy if he comes in contact with them unless his discharges touch the mucous membrane or a cracked skin. But he can infect locality. How he does it, of course, I am not in a position to say, but my idea is that a plague-infected person, if he goes to a healthy place, infects that locality, and in some way or another, which I am not in a position to state, the disease is communicated to the rats. It may be that the discharge of this infected person soils the ground, or soils some eatables which the rats consume and they thereby get infected. However, this is a point upon which I can give no information. Having done this, the germs seem to get some increase in virulence, and the rodents, by their discharges, scatter the germs of plague broadcast. Practically man as a propagator to another man is a less important factor than rats. Another reason which I give in support of this evidence is that in hospitals where we find that a large number of patients suffering from this disease are congregated, where their discharges are removed from one place to another properly, the inmates, the surgeons, and even the people kept under observation are not affected, and if they are affected I have not been able to see whether the infection was got from the hospital or from their own houses. It is possible the hospital building might become infected just as much as any other house, and I believe a similar thing must have occurred in one of the hospitals of Bombay; I think it was the Mahratta Hospital—where a number of people got the plague. But, however, this is a surmise, and the full details of these incidents are not before me. But I say that a Hospital is as liable to infection as any other house; but the large number of disinfectants used, the intelligent care with which the discharges are handled and the great care taken to see that nothing eatable is thrown into the wards and places where the people live, are good safeguards against the infection of the dwelling itself.

17,926. Have you any instances in which it is clear that rats have actually infected a human being, and where you can exclude human conveyance distinctly?—Yes, if we can rely upon the history given by patients. I have two cases in which the history was something to this effect. A rat was found in one of the rooms. The patient, before she got the infection, took the rat and threw it out, and then with plain water she scrubbed the ground with her hands. In about 6 or 8 hours she felt a sense of chilliness, then fever began, and she went through the whole course and died.

17,927. How do you exclude contact with a plague patient?—There was no plague case at the time.

17,928. Was that in this city?—Yes, in Bombay.

17,929. Was there any plague in Bombay at that time?—Yes.

17,930. But there was no plague in the same house?—That is so.

17,931. What about the houses in the neighbourhood?—The neighbourhood was infected.

17,932. Have you any other case?—A Hamal is reported to have removed two or three dead rats from the house. After that he got a sense of chilliness and went through the whole course. The information was that he had a sense of chilliness within five minutes but, as I say, this case was only reported to me; it is second-hand evidence, and I could not give it with the same confidence as I gave the last.

17,933. What is your view with regard to segregating the sick?—I find that the segregation of the sick is not of so great importance as the segregation of the healthy, because the sick person himself is not likely to communicate the disease to the healthy. He may remain in the house if the house is well ventilated or in a sanitary condition, that is such a house where not only plague patients but any patients may stand a chance of recovery. He has to be removed from the house not because he himself is a dangerous person, but because he remains in the house and therefore other healthy people ought to remain in the house. But since the discovery of Prof. Haffkine's prophylactic I am strongly of opinion that in a large majority of cases plague patients may safely be allowed to remain in the houses and be treated by inoculated persons. Thereby we could reduce the mortality of the plague, because in spite of three years' bitter experience the people still have a dread of hospital, though it is unfounded, and the effect of the nerves or mental condition upon the course of the disease may easily be judged by those of us who are medical men. So if it is decided to treat the patient in sanitary houses with the condition that those who treat the patient must be inoculated, I think the percentage of plague mortality would be reduced, I will not say considerably, but to some extent.

17,934. Have you treated a large number of cases yourself?—No. During the first epidemic I treated about 17 cases, but, since then all the plague cases are hospital cases and the medical practitioners do not get opportunities of treating them. We treat them in the beginning until they are declared to be plague, and then they are sent into the hospital. In the first epidemic I treated 17 cases of whom 12 recovered and five died.

17,935. In the first epidemic did you encounter many cases of the pneumonic form of disease?—No. Before the death of Dr. Manser I do not think the pneumonic form was recognised.

17,936. It might have occurred?—Yes. I have a recollection that one case which recovered under me had pneumonia as well as a bubo, but at that time pneumonic cases were not thought of.

(Witness withdrew.)

Mr. J. McDonald.

Mr. JAMES McDONALD called and examined.

17,937. (*The President.*) You are Headmaster of the Scottish High Schools, Byculla?—Yes, the Bombay Scottish Education Society's Schools. I should like to say I am in no way a professional medical man, but I shall be very glad to answer any questions.

17,938. (*Mr. Cumine.*) You are a non-official?—Yes.

17,939. You are not put forward by Government as a witness?—I am not. The Surgeon-General wrote to me, that is all.

17,940. How many years have you lived in Byculla?—Upwards of 32 years.

17,941. When the plague broke out did you take charge of the district?—I took charge of a section. The section is so named, but it runs from the Byculla Bridge to Kala Chowki.

17,942. How long have you been in charge of that section?—Since the beginning of plague till the present time.

17,943. Have you found in your section any overlapping of different departments?—I found great difficulty from the overlapping of the Health Department and the Engineering. Later on, Plague Officials increased the

difficulty, for the three departments were not unfrequently found to be engaged in the same inquiries. The Police sometimes made a fourth difficulty, when getting statistics on their own account.

17,944. What are the principal classes of people in your section?—Mostly a low class, either Mochis (shoemakers), Mahars, or workers in the mills.

17,945. What was it which specially enabled you to get a hold on the good-will of the majority of the people?—Firstly, they knew that I lived in the neighbourhood, and had some little position there. Then I was obliged to use a little money to help the poor—not the plague-stricken, but the poor—because there was much destitution in the place. Then I got some funds from Dr. Weir, and also 100 rupees from Sir James Campbell's Plague Committee.

17,946. When you got this money did you experience any difficulty in getting timely information of plague cases?—No; I should say that when I was informed about plague cases I went quietly and sympathetically to the people, and gave them advice quietly. Then, of course, I assisted them in any way I could, sometimes writing five, six, and seven letters in the morning to employers of labour to get employment for those who wanted it.

17,947. Do you think from this way of treating people that the number of cases in your section was probably less or greater than in other parts of the town?—I think considerably less, because they came with timely notice, and, when necessary, I helped them to remove the patients quietly, and they had no fear that there would be any rough treatment.

17,948. In spite of your conciliatory treatment there was a certain number of cases of concealment, I think?—There was, and is; there has been all along.

17,949. Would you attribute the greater part of these cases of concealment to intention or ignorance?—To ignorance, and the hope that it might not be plague, and so removal would be saved.

17,950. When a person had been removed to hospital, did you find it had a good effect to go to the hospital yourself afterwards and see him?—An exceedingly good effect. I know that those who recovered consider that their recovery was due to my having spoken for them to the doctors and nurses, rather than to the great care both doctors and nurses took of them. They believe that, although I had very little to do with it, and told them so.

17,951. Did you find that the nature of the carriage in which the people were removed to hospital had anything to do with their unwillingness to go?—Yes, often.

17,952. What would they have preferred, do you think?—I think they would have preferred a hand-carriage, that is to say, a species of dooli. They do not like to be wheeled through the town in a lying position; they would prefer a light hand-dooli with some covering over it.

17,953. Did you find that the system of having house-to-house visitation by native gentlemen was a permanent success up to the very end?—No, I did not.

17,954. What was your experience?—My experience was that at the beginning the attendance of native gentlemen was pretty fair, but I found as we got a little further on that cases cropped up in which these gentlemen allowed their feelings to get the better of their reason. They did not wish to hurt the feelings of their caste men especially, and they complained that a patient was sent to hospital under the name of some other person. The great object was to get the name of the sender put down as having sent the man to the hospital.

17,955. Did it come under your observation that the plague took any particular line in going across the town?—Yes; it was brought to my knowledge at a very early period. I have for years been observant of sickness in the town, firstly, from a conversation I had many years ago with Mr. Tomlinson, the water engineer here, who assured me positively that if care was not taken, and if the town was not drained properly of the great quantity of water which was being let in and deposited in the soil, and if waste of that water was not prevented, some serious evil would follow. Talking this matter over with Colonel Weir, he called my attention to the line from Mandvi to the Market, and from the Market on through the wards, going gradually northwards. Noticing it was actually taking the line which Dr. Weir had pointed out to me, I said to the people of my section—they are on one side of the railway—"It is coming along that line, and without doubt, "if you are not careful to prevent people from the "other side coming round here, they will come round "here, because they know we are quiet here, and you "will have the plague at such and such a time." And they did have it.

17,956. What is the connection between that line and the subsoil?—The flow of the subsoil water is north-west, in the direction of Worli, and then it turns round to the east and north-east, and in this direction plague goes gradually round. It has done it for these three years. It is pretty heavy to the west of the section, and now is coming right into this section.

17,957. I suppose you got some credit from the people for that?—Yes, especially because I did not tell them whence my information was. Had I told them, they would not have believed it. I am supposed to be a great doctor, although I do not profess to know anything about it. They speak of me as the Bara-Doctor-Sahib.

17,958. From what you have seen of disinfection you think, I understand, that one very important point is the goodness of the material supplied?—I think so, if it is to be of any use. I am not a great believer in disinfection.

17,959. You have something to say with regard to quicklime, I think?—Yes. In some cases they used quicklime, and the lime was certainly anything but quick in many cases, because I tested it when it was brought to disinfect the houses, and complained about it once or twice.

17,960. Do you also attach great importance to keeping the same plague officers in a ward throughout as far as possible?—Yes, very much so. I know that it could not be helped, but the change of plague officers certainly tended to disarrange many things. I had the good fortune to be always in the same section. As I was practically independent, they let me alone, and did not interfere with me in any way.

17,961. Was one of your chief reasons for thinking that European officers should be kept in one ward as long as possible, that then the superior officers know their subordinates, and can prevent them from doing any acts of oppression or extortion?—Yes. I thought in the case of Mr. Stewart, for example, that he knew the men intimately, and was able, when a complaint was made, to use his discretion to more advantage.

17,962. Have you any reason for supposing that the barbers are rather dangerous people in plague?—Yes. I am afraid that they still use razors to cut the buboes, especially about the neck. I have seen them in the neck, I have seen them in the chest, and I have seen them in the groin. I have mentioned in my précis one case which came under my notice at a very early date, but, strange to say, I have had several accounts of cases since which have taken place. I make it a point now, whenever I meet a barber, to caution him not to interfere with any buboes. Many of these barbers are of the species of the old leech, and profess to cure in this way, but I think it is dangerous.

17,963. Have you anything to say with regard to inoculation?—I was inoculated myself, together with my wife, son, daughter, and 14 servants. We were, I think, among the first 50 cases which Prof. Haffkine inoculated. I was a believer in inoculation, I am a believer in it. Two or three things have come under my own observation which perhaps are worth knowing. I have a son who is a medical man in the Army. He was up in the front and was invalided for three months; he took three months sick leave owing to his having very severe fever, and came down here, but could in no way get rid of it. At the end of three months he was obliged to return to duty, and was sent up to Baroda to the 8th Regiment, where plague had broken out. My wife advised him to be inoculated, and he had a desire to be inoculated, but thought that it might increase his fever. However, when he went up there, before he could advise others to be inoculated, he preferred to be inoculated himself, and from that date to this he has had no return whatever of fever. The same happened to his servant. I have also a young man in my house to whom the same thing happened, and there is a case which I know of, of a native who was of a very poor habit indeed, and had asthma for several years. He thought he was dying, but he was

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inoculated, and from that time to this he has recovered so much, that he is now thoroughly stout and has had no return of the asthma till within the last two or three days. The gentleman, whose clerk he was, told him that he wished the other clerks to be inoculated, and asked him about the facts. The clerk told him, "You "see now I am a strong man, but within the last three "days I have had something like a return of asthma, "and I am going to be inoculated again." I think it is not an uncommon idea amongst the people that inoculation either affects them very badly, or that they are likely to recover from fevers if they are inoculated. I think there is something with regard to the effect on fever from what has come under my own experience.

17,964. (*The President.*) That is malarial fever, I suppose?—I presume so.

17,965. (*Mr. Cumine.*) How long ago was the clerk inoculated?—Twelve months ago.

17,966. All this is within your own knowledge?—Yes, he is a clerk of Mr. Vilhaldas Damodhar.

17,967. (*Mr. Hewett.*) Have you any system of corpse inspection?—Oh, yes, they allowed me to do it very freely. I do not insist upon it in any way, but they ask me to do it. I ask them if there are any buboes, and they invariably say, "Come and look," and if I am doubtful about it I do go. I have no difficulty about it, but I think they will object in most cases, and especially would they object to young men examining.

17,968. Do you think that a Hindu would like to have his body examined by a Muhammadan or *vice versâ*?—No, I do not think so. My experience is that they are quite willing that a European should do it, but they do not like dark persons to examine them if they are of another faith.

17,969. Do you think that Muhammadans would resent the examination of female bodies?—I think they might, but they have not.

17,970. With you it is a different thing?—I have no difficulty, but I think they might resent it. The fact is they will resent it in the case of young doctors—they resent the examination of women by them when they are well. I have known of such cases, but I have not found any objection personally. I make myself very familiar with the people. I do not know whether you have seen the printed Marhatti letter of mine to the people. That sort of thing I usually read to them, or get somebody to read to them. They gladly listen to a thing like that. They also prefer that one should hear their story, even if they do not get what they want. I think it is most important that they should be heard, even if one does not agree to give them what they want.

(Witness withdrew.)

Mr. A. B. Davur.

Mr. A. B. DAVUR called and examined.

17,971. (*Mr. Cumine.*) Are you stone deaf?—Yes.

17,972. Have you any medical qualifications?—I have practised medical electricity for three or four years.

17,973. Have you any degree?—No.

17,974. You have volunteered as a witness, I believe?—Yes.

17,975. Have you treated any plague cases?—No, on account of the strict plague measures.

17,976. You mention in your paper a certain treatment for plague patients; has that treatment ever been applied in practice?—No.

17,977. Have you any personal experience of the results of inoculation?—I have acquired personal experience by way of observation, asking patients, and so on.

17,978. How many cases have you observed?—I was in Arthur Road Hospital one day and examined some patients there.

17,979. You mention in your paper, in speaking of the infective power of rats, that there is a worm of a certain kind in their interior which helps to spread the germ; do you know as a fact that this worm exists?—Only from natural history.

17,980. As you are deaf, perhaps you would like your paper to go in in its entirety as your evidence?—Yes.

"The following causes may be attributed to the origin of the different outbreaks of the plague:—

"*Firstly.*—In a hot country like India, when the summer is very severe and intolerable for two or three years, the soils bring forth very noxious and unwholesome exhalations of a fermentation (*i.e.*, bacterial) nature, just after the abrupt and continuous occurrence of heavy showers of rain for a considerable time. This is a natural cause or a phenomenon.

"*Secondly.*—Again, in a hot country like India, the wholesale merchants, brokers, and dealers in corn and grain, during a year of plenty when the crop is good, make large purchases of different sorts of grains with a view to make a good bargain in future when there is a famine or scarcity of grains. Now, if such large quantities of grain be not sold away in due time on account of the want of good demand they get damaged, and hence become unwholesome and unfit as an article of food. Grains, when hoarded up and kept for a considerable time without being used, produce a very noxious exhalation, a very bad stench which really affects the whole atmosphere of those localities where they are kept; and hence a great mortality of rats during those seasons.

"*Thirdly.*—A very imprudent and erroneous step was taken by the Bombay Municipality in respect with the drainage system, in the year 1893 or 1894, two or three years before the plague first broke out in Bombay, which has ever since produced a very bad effect upon the health of this city; and it is (*a*) the annexation of private or proprietary privies or closets with public gutters; and the other (*b*) is the erection of too many public urinals, which is no better than a mere nuisance. These can be regarded as creative causes.

"I should, therefore, in order to prevent the contagion of the epidemic from any further propagation, like to suggest a word or two about large and small quantities of corn and grain which are kept in stock, that a thorough inspection of all the godowns, store-rooms, and other places where they are kept should be made for at least once or twice a month, and that all damaged and noxious grains should be caused to be destroyed by fire: and the sacks, bags, and other containers ought to be either burned or thoroughly disinfected by boiling them in hot water.

"*About Disinfection.*—The present method of cleansing the houses where dead rats are found, as well as cases of the plague have occurred, with water, phenyle, and other disinfectants, is not good at all in this present situation. They ought to be either destroyed by fire, if possible, or cleansed with very hot sand or ashes, or, after removing some movables (which should be thoroughly disinfected and exposed in the sun for a few days) petroleum oil should be poured upon the ground and walls, and, afterwards, spreading hay upon the ground, they should be burned, provided that proper precautions are taken against fire already. But care should be taken that no water should be used at that time. Of course, the houses should be whitewashed afterwards.

"*About the Manner in which the Disease is communicated.*—The contagion of the plague is communicated through the skin. The plague microbes first make their abode in the corners of the eyes and nostrils, as well as in the middle ears, and from thence they get into the elementary canal through the eustachian tube and the jugular nerves. And afterwards they get into the regions of the chest and the stomach. Sometimes they easily enter the skin through scratches made into the nostrils with points of scissors while clipping the hair therein, or upon the membrana tympani and meatus auditorius internus while pricking the ears. Sometimes they (*i.e.*, the microbes) enter the eyes of other persons (*i.e.*, sound) or of those who attend upon the patients, before whom they (*i.e.*, the patients) either sneeze, cough, or upon whose faces they sometimes spit in a fit of temper. Or they enter through the cuts on heels of those poorer classes of people who go barefooted, who may happen to pass across some place upon some footpaths where some patients might have vomited or made water beforehand. The disease may be communicated by coming in close contact with the bodies of the patients or by putting on their clothes

through mistake. It may also be communicated by way of cohabitation, provided that neither of the parties is professionally a bad character. It can also be communicated by means of hair and shaving brushes and the aprons of barbers, or through some commercial articles, public conveyances, or through the dirty dresses of hawkers in household requisites.

"*About the Effects of Preventive Inoculation.*—As to the effects of preventive inoculation, it can be highly recommended, but not without caution. For there are some objections for it which ought to be very carefully remembered.

"The following can be regarded as some of them :—

1*st.*—The strength, manner (of injecting it into the proper parts of the body), and the number of doses of the serum.

2*nd.*—The general health and the physical condition of the persons to be inoculated.

3*rd.*—The climate and the general physical condition of the cities and villages in which they live.

4*th.*—The rules and sentiments of the people as well as their manner and mode of living.

"The following are some of the general observations upon effects of the serum. It causes fever and pain; the former leaves the persons of itself after a few hours and the latter may be tolerated to a great extent by a purgative if taken a day previous to inoculation. Buboes sometimes appear, generally in the left arm-pit, and very seldom in a groin (right).

"Its effects upon some persons (*i.e.*, those who live in villages as well as in large and comfortable bungalows or houses, with sufficient air and light, and on good food and pure water) are somewhat lasting for about two or a little more than two years; whereas in some persons (*i.e.*, those who live with a number of families in houses, situate in a very thickly-populated city and upon very poor food and bad water) are more temporary.

"The effects of inoculation upon such persons as the following are very good and salutary :—Persons suffering from, or labouring under, some mental disorder, nervous debility, nervous prostration, rheumatism, neuralgia, paralysis, gout, tumours and other morbid growths, hysteria, disease and disorder of the spina cord, scurvy, leprosy, scrofula and other chronic diseases of an infectious nature.

"But the effects of inoculation upon some persons as the following are generally bad, and sometimes they prove even to be fatal in case when such persons are attacked by their old diseases :—Persons suffering from, or labouring under, any disease or disorder of the kidneys, liver, bladder, stomach, lungs, the heart and other viscera and such other diseases which are easily subject to bronchial and catarrhal conditions.

"The following is a list of such persons who are generally free from the epidemic. Nevertheless they are subject to catching the contagion of the disease if in case they neglect to take due notice of any cuts, scratches, bleeding from the nose or gums, or from the fingers when the nails are badly pailed :

"Persons, whose temperature is at 99°, keeping thin yet always enjoying good health, having hot, much thick and red blood with smooth, bright and dry skin rather somewhat wrinkled; teetotalers not easily subject to catching cold, fever and so on; chaste, religious, and of refined habits not given to pleasures; not practising polygamy, of studious, sedentary and laborious occupations; dealers in oils, colours, lims; grogshop-keepers and their employees; mill hands and employees in gasworks, druggists and vendors of medicines, perfumers, tobacconists, mechanics, blacksmiths, and those who work before fire.

"Besides the above-mentioned, there are others who are entirely free from the epidemic :—these are the prostitutes, their paramours and visitors, professional bad characters, heavy drinkers, opium smokers and eaters, and the bhâng and gânjâ smokers.

"There is one thing which is very remarkable and I am sure that it will indeed draw the attention of "Experts," which is this, that amongst all the population of Bombay, nay, even throughout all India, which represents a lot of peoples of various nationalities, castes, and creeds, there is not a single nation or a tribe like those of the Chinese and Japanese which is exempt from the terrible dread of the plague. For there is not a single case of the plague known as registered to have been occurred in either of these communities. Nevertheless, after a close observation and minute inquiry, it is not a difficult task at all to assign the cause to any particular thing or things. The causes, as far as I know, are these :—(*a.*) The peculiar formation and texture of their blood; (*b*) their snug and cleanly habits (though whatever may be said of their lives in their native places, but here they live a quite different life); (*c*) their habits of taking hot and weak tea now and then (for they never take cold water in its simple form in their life except fresh rain water); (*d*) they never take English, Native, or any other foreign medicines except those of their own countries; (*e*) and lastly, the thinness of their population in this country.

"*Difference between a False and a Genuine Case of the Plague.*—Seeing that much confusion and many blunders are made in finding out the genuineness of the plague cases on railway stations, detention and segregation camps, I should deem it to be proper to throw some light upon this piece of inquiry.

"The first and the most obvious symptoms of the disease are fever and buboes. The presence of fever and buboes is found in a false case of the plague as well as in a genuine one. But the fever is generally either of a remittent or of a simple nature; the latter is very common and can be easily caused by fatigue, hunger, hard work, want of good food and water or recreation or on account of some slight change in the weather or by fear or anxiety; and therefore it leaves the sufferers very soon and that without any remedy.

"As to the buboes in males, they appear on account of taking a long journey on foot, or fast or excessively running, or by climbing hills or precipitous places, or while wrestling in their athletic pursuit, or it may be a pure venereal case, or through some change in the weather, or on account of gonorrhœa or any other disease of the urinary organs which they may be suffering from.

"In females they (*i.e.*, the buboes) are sometimes of the venereal kind; or on account of their being very much taken up with their household works, or owing to their slender build or weak constitution.

"They are sometimes found on women labouring under pregnancy either a little before or after delivery. This is owing to their miscarriage or extreme weakness or debility or through the damp or moist atmosphere of their houses.

"As to the buboes which are found on children, they easily appear on account of their childish mischief, while playing at the hide-and-seek game or climbing some trees, jumping or by playing at marbles when if some nerves be straitened; or if they get some sudden shocks or sprains in their legs, or through some change in the weather.

"But these kinds of buboes can easily be distinguished from those of the genuine case according to their shape, size, and colour.

"As to the shape of the bubo (in a false case) it is somewhat of a round or circular form. Its size is a little more than a marble or sometimes nearly as large as that of a full grown almond. As to its colour it is somewhat of a white reddish one.

"As to the fever and buboes in a genuine case they are of the following nature :—The fever is of the typhus kind (please see my paper on the Plague). As to the bubo (in a genuine case) it is nothing but a mass of fatty substance somewhat of a yellowish colour like that of wax or cheese (when cut) rather hard in the beginning, but getting softer either when going on to putrefaction or under the influence of poultices, very sticky and of a bad stench. Its shape is somewhat of an elliptical or an oval one. As to its size it is from an ordinary to a full-grown mango stone, much thicker in the middle and very intolerably painful when putrid. The bubo appearing in the throat always proves to be the most obstinate and even fatal than those which are found in the armpits, stomach, and the groins; and hence there is little or no chance for the recovery of such patients. Its colour. It is slightly of an olive colour in the beginning, but of a darkish black when putrid.

"It will not be considered as improper or useless if a word or two be said about this piece of inquiry.

"*Plague Expressions.*—The complexion of the face is somewhat of a darkish colour. Eyes wide open. Eyelids thrown backwards. Enlargement of the pupils. Standing and walking postures not erect, but rather bent (though many an attempt made by the patient to walk erect in order to avoid suspicion); and extreme fear and anxiety,

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"*New Suggestions for the Treatment of the Critical Cases of the Plague.*—It will not be amiss to throw a suggestion or two for treating plague patients in a very critical state when the hospital authorities do not find a single ray of hope for the recovery of such patients.

"1*st.*—First of all the region of the heart and the stomach and the intestines ought to be very thoroughly cleansed by means of a douche. Of course the preparation for this kind of douche must be of a bactericidal nature.

"2*nd.*—That hot and fresh blood of some vultures such as feed upon dead carcases of plague patients (especially those who died without any medical assistance) should be introduced directly into the bodies of the patients through an artery or a main nerve, at the same time keeping the chests of the patients rubbed either with cod-liver oil or oil of almonds in order to strengthen their hearts; but no strychnine or any other injection should be used at all.

"3*rd.*—That electric currents should be introduced right into their blood—of course at the same time keeping their hearts strengthened as already described above.

"*About Clinical Thermometers.* — That many an innocent patient becomes a victim of the diseases of some other patients through the instrumentality of the clinical thermometer on account of the germs of the diseases found, in the febrile moistare of the skin, sticking to it.

"Again one thing must be remembered very thoroughly, that the natives are in the habit of getting their armpits shaved by the barbers. Now arm-pits, like cheeks, are not flat parts of the body for an easy shaving. So it is probable that razor-cuts might be found therein.

"Therefore it can be remarked that it is absolutely necessary either to disinfect the thermometer or allow it to remain into some warm water for a few minutes especially after taking the temperature of any patients suffering from any infectious disease."

"*The Bubonic Plague.*

"I.—What is it?—It is a fever.

"II.—*Its Antiquity.*—The plague is of a very remote antiquity. It seems to have visited Egypt, Mesopotamia, Asia Minor, Arabia, China, Persia, India, and some other parts of the globe, on different occasions, and in different forms ever since the times of the Pharaoes of Egypt, 1490 B.C., and the Shepherd Kings of the East and lately in Europe, especially England.

"III.—*Its Name.*—The proper name of the fever is Typhus (Gravior).

"IV.—*Its Nature.*—The fever is of a very putrid, contagious, and malignant nature. The temperature of the body of the patient is from 104 to 106 degrees, and the pulse beating very quickly and heavily.

"V.—*Its Causes.*—Among the most obvious causes which contribute to its contagion, the following may be enumerated—(*a*) Noxious exhalations from stagnant waters of the gutters; (*b*) slimy mud and rubbishes taken from the gutters and exposed upon the roads to be dried up by the sun; (*c*) corrupt, damaged, or noxious grains; (*d*) putrid fish, meat, fruit or such other eatables; (*e*) residence in confined situations where the atmosphere is unwholesome and the rooms not properly ventilated; (*f*) intemperance and immoral habits; (*g*) tropical or very hot climate, especially after a very heavy rain; (*h*) and the want of pure water and due cleanliness.

"VI.—*How it enters the Human Body.*—The contagion of the plague enters the human body through cutaneous lymphatics, and thence produces the disorder of the lymphatic glands.

"VII.—*Does the Plague make use of any Animal Agency for the Propagation of its Contagion?*—Yes, the rat, the fly, the gnat, and such other creatures have their share in conveying the miasms and other poisonous elements by means of microbes, bacteria, bacilli, protozoa, and so on.

"How does it do so? Its manner of working is thus:—According to my opinion, that there is a *worm* of a certain kind, lodged in the belly of rats of a certain kind (perhaps such as live in the fields and gutters). The worm in the belly of the rat either becomes ill, or dies away when the rat partakes of some putrid grain, meat or such things or inhales the noxious exhalations from the gutters; and thus the rat is infected with a poisonous fever. Now, men contract this poisonous fever in any of these ways: (*a*) that the rat, after entering the godowns, the shops or houses, makes some dirtiness there, and afterwards the fly, the gnat, and such things sit upon it, and then they sit again upon human bodies; (*b*) or through the bites of such infected rats; (*c*) through the application of the febrile moisture of their skins by their jumping upon or dashing against the human bodies while they are asleep; (*d*) or by hiding themselves into their clothes for the fear of cats; and thus men cause inflammations upon their own bodies by scrubbing it with their nails, which may, perhaps, afterwards take the form of buboes and such other tumours.

"VIII.—*Its Symptoms.*—Fatigue, extreme debility, unquenchable thirst or desire for thirst, uneasiness, appearance of buboes, carbuncles or other inflammations, extreme irritations in the arm-pits and the groins, extraordinary heat in the body and in the head, and so on.

"IX.—*Is the patient aware of his Situation when he is infected with the Epidemic?*—No, he comes to know of it two or three days after the setting in of the disease.

"X.—*Is the Plague communicable? If so, how?*—Yes, it is communicable. Not by association, but only by contact alone. For if proper precautions be taken, then other individuals living in one and the same house may be free from it.

"XI.—*How many Species of the Plague are there? And what are they?*—There are three species of the Plague. (*a*) In the first species the energy of the brain and the nervous system is greatly impaired, indicating by a certain kind of change in the speech of the patient, such as low drawling and interrupted utterance, the tongue is more or less white in the centre and at the extremity, countenance pale, strength much impaired, the anxiety great, and the stomach extremely irritable. Rigors and pain in the lower parts of the back are found. (*b*) In the second species the state of the brain is horribly excited, intense pain in the head, thirst frequently considerable, though sometimes wanting, countenance flushed, and utterance hurried, frequent, epistaxis, appearance of glandular swellings and their disappearance without making a slight change in the system, appearance of buboes in the arm-pits and groins (right). Carbuncles appear on different parts of the body, and they rapidly show some disposition to become gangrenous, although the patient is attacked by a high delirium and thus brought to the termination of life within two or three days. Sometimes he lingers on to the seventh day, but seldom the eighth or ninth day. (*c*) The third species is somewhat akin to the last one save the symptoms are much milder and the brain comparatively a little affected. The buboes and carbuncles go on rapidly yet mildly to suppuration. And if prompt and early precautions be taken, the patient recovers from the epidemic.

"XII.—*The Duration of the Disease.*—The exact duration of the disease is uncertain; for it is various. Sometimes the effect of the contagion results in the immediate extinction of life. Sometimes the patient survives but a few hours, sometimes he lingers on till the thirteenth, fourteenth, or even the seventeenth day of the disease.

"XIII.—*What Changes are observed to have been wrought in the Body of the Patient on the post-mortem Examination?*—The omentum, the stomach and the intestines gangrenous in some places, the liver in a state of congestion and considerably enlarged, and the gall bladder filled with a black fetid bile and the pericardium with a bloody fluid. Proofs of inflammation and gangrene are also observed in the brain and its investing membranes, in the lungs and in the kidneys. In many instances the glandular system has been found in a diseased state, the blood black and loose in its texture. On a minute search, one, two, or three microbes are found in gall bladder, pericardium or in the glandular system. These colonies of microbes belong to the plague-propagating class. The complexion of the face as well as that of the whole body appears to be of a light dark colour.

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"*My Method of the Electrical Treatment for the Cure of the Bubonic Plague.*

"I.—Injections.

"II.—Mixture.

"III.—Electro-chemical bath.

"IV.—Chemical application of electricity.

"V.—Applications of cupping-glasses, ice, and oily frictions.

"VI.—The uses of sea-breeze and sea-bathing.

"I.—*Injections*—(*a.*) *Chlorine or Gaseous Injection.*—Take some sea-water, or, if not, take some ordinary drinking-water and add a little quantity of chloride of sodium into it and separate the elements from the water by introducing electric currents into it. The following process is being done. The oxygen gas which is in the water mixes with the chlorine (*i.e.*, a greenish-yellow gas produced from the salt), and thus chloride of sodium becomes hypo-chloride of sodium. The same is the preparation for the injection. (*b.*) Oily injection which is nothing but the pure oil of almonds.

"II.—*The Mixture.*—It is composed of sulphate of quinine, antipyrin and tincture of camphor.

"III.—*Electro-chemical Bath.*—The electro-chemical bath is administered in the following way: According to my theory for the present epidemic, the patient is placed up to his neck in a large metallic tub which is filled with iced or cold water, added to it a little quantity of hypochlorite of sodium [as per the injection marked (A)] together with some hydrochloric acid, and insulated from the ground. The patient sits in a tub upon a bench of wood or wicker-work insulated from the tub, and having the length of the body. The tub is to be connected with an electric battery by means of a copper or brass wire, and the patient holds one electrode in his hand. Afterwards the battery should be worked on.

"IV.—*Chemical Application of Electricity.*—An oval piece of brass of medium thickness (*i.e.*, $\frac{1}{10}$th of an inch) and about 4 inches in length and 2 inches in breadth should be taken. Then a piece of fine linen previously saturated with hypochlorite of sodium [as per injection (A)] is placed upon the tumours (*i.e.*, buboes or carbuncles, whether hard and dry, or soft and gangrenous), then the piece of brass be placed on the linen. Another piece of brass which is about 4 inches in length and an inch in breadth, having round corners, should be placed upon the belly of the patient near the abdomen like the first piece of brass. Then they should be connected with a battery which should be set to work.

"V.—*Applications of Cupping-glasses, Ice, and Oily Frictions.*—If the inflammation be not very severe and the pain tolerable, cupping-glasses with previous scarifications may be used with much advantage. For the nature must be assisted in the work of throwing off the morbid matter by the pores; because sometimes the emetics, the laxatives, the purgatives, and the sweating regimens are of no avail at all.

"*Application of Ice.*—In order to check the strength of fever, the intolerable thirst for water, and for the burning inflammations and irritations, the use of ice is absolutely necessary. It is applied to the crown of the head, held into mouth, arm-pits and groins. It should be used in their bathing-water too.

"*Application of Oily Friction.*—Perhaps it will sound very strange into the ears of some medical gentlemen that it is essential to make use of oily frictions in this epidemic. But if we look at the statistics of the deaths occurred by this epidemic we shall hardly find three, four or five persons out of 100, whose occupation is that of a dealer or worker in oils. Besides these, a little experience will teach us that it is a death, not only to microbes, insects, or flies, but even to worms, mice, and little birds too, if they are entangled into a small quantity of oil. For this purpose I recommend the use of the oil of almonds, because it has a soothing and healing property in itself.

"VI.—*The Uses of Sea-Breeze and Sea-Bathing.*—It is very essential that such patients should have the advantage of sea-breeze and sea-bathing. If such a thing be not practicable, then let a linen shirt and a trouser be dipped into sea-water and wrung off and then worn by the patients, wet and cold, allowing them to walk here and there in the ward. Let them have cold baths, two, twice a day.

"I should here like to make a request that an anatomical examination be made upon some rats in order to establish my theory, that there is a worm in the belly of some rats; that the true origin of the epidemic be found out.

"It will be found out, after a careful reading of this paper, that my electrical treatment for the bubonic fever, which I have laid before the public, is perfectly harmless and will prove to be an efficacious one, if a trial be given to it. Nevertheless, if any doctor or doctors entertain any doubt about its efficacy, I shall, however, request them to try it upon some lower animals by inoculating them with the matter taken from the buboes or carbuncles from any patient: and then try an experiment upon them according to the directions I have given. If the experiment proves to be successful, then let patients be treated accordingly. If not, we will leave the matter off.

"*N.B.*—The present is the true copy of my *Paper on the Bubonic Plague*, which I had written in the middle of the month of October 1896, when, or a little after, the plague first broke out in Bombay. It had been shown to some doctors and public men of established reputation, whose names I cannot give without their permission. But their names may be given with permission, if required. The manuscript copy may be produced, if desired."

(Witness withdrew.)

Mr. L. Godinho.

Mr L. GODINHO called and examined.

17,981. (*The President.*) You are Deputy Health Officer here?—Yes.

17,982. Of what district?—At present I am at E Ward East.

17,983. (*Mr. Hewett.*) What are the means by which plague is communicated?—First by personal contact, secondly by kit, thirdly by rats, and fourthly by aërial infection.

17,984. When you speak of personal contact do you refer to the contact of a person who has bubonic plague or pneumonic plague, or both?—Both.

17,985. Can you explain how you think a person with bubonic plague communicates it by personal contact?—I have seen, especially among the poorer Hindu classes, females attending plague cases with buboes and nursing them. The females never wash their hands after nursing the sick, and they carry their spittle to their own noses or mouths.

17,986. Do you think that was through the sputum?—Yes, and the saliva.

17,987. Would not that point to the cases being pneumonic?—The cases were not pneumonic.

17,988. Have you any instance in which a person with bubonic plague gave pneumonic plague to another person?—Only one.

17,989. Will you specify it?—In Carpenter Street a medical man was treating plague cases which were all bubonic. He got fever and then showed symptoms of pneumonic plague. On the third day he developed a bubo. He had both forms of plague, pneumonic and bubonic.

17,990. Have you any instances in which a pneumonic patient gave bubonic plague to another person?—Yes; in the Mahratta Hospital a Resident Surgeon suffered from pneumonic plague. His nephew and another relative attended upon him. When they went back home the nephew suffered from plague and died.

17,991. Is that the only instance you have in that form of communication?—In this special instance several suffered. Altogether about eight persons suffered, and all died. They got it from the Resident Surgeon. Some had the bubonic form and some the pneumonic.

17,992. Do you think that funeral ceremonies tend to communicate it?—Yes.

17,993. Do you mean from the body or the clothes of the deceased?—I would classify those separately. So far as the Hindus are concerned they have got special ceremonies which the female kind conduct. First they make an ablution, and then afterwards put some stuff into their mouths, and noses, and other

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orifices. The Muhammadans close the different orifices by a plug of cotton, camphor, and spices. A rupee or some coin is placed in the mouth; afterwards this is taken off, and replaced, and I have seen the womenkind suffer from plague through handling these coins.

17,994. Can you give us any instances of infection from clothes?—Yes. I know one specific instance in which a Christian suffered from plague at Lanauli. A month afterwards his nephew used his blanket and got the plague and died.

17,995. Was there any plague at Lanauli at the time?—Yes. The nephew used the blanket he had in Bombay in a house in which there was no plague.

17,996. Have you any instances in which plague has been communicated through rats?—Yes. In the present epidemic, towards the end of February 1898, sick rats were found in Dukar Gali in Tanaswadi. They made their appearance on the ground floors at the east end of the Gali, and then rapidly travelled to the west end, keeping to the rear of the Galis, where water could be easily got. About a week after the appearance of sick rats the inhabitants of Dukar Gali began to sicken and die of plague. The first cases happened in houses where dead rats had been found. From Dukar Gali the rats travelled north-west to Burrow's Lane. A listless rat was found on the 5th March in No. 3 Burrow's Lane, and eight days after a servant boy, who is said to have killed and burnt a rat, was attacked with plague. I know that the boy did play with the rat and did burn it.

17,997. Do you know for a fact that the boy was not subject to any other source of infection?—Yes.

17,998. Was there no plague patient with whom he might have communicated?—No. The residents of this house were living then in a tent at Kennedy Sea Face.

17,999. Under observation?—No; he was a medical man, and had his own tent.

18,000. Why could not the boy have gone to some infected portion of Bombay, and there got plague?—The boy was in the tent, and used to go back to the house to sweep it, and he brought the news that he saw a sick rat there. The boy was in the tent all the while.

18,001. What security is there that the boy did not go to the town?—I cannot answer that.

18,002. I mean can you exclude all other possible means of infection?—I am almost certain the boy did not go anywhere else, because this refers to my own servant boy.

18,003. Have you had experience of mortality among rats before cases of plague occurred in human beings?—Yes, and also afterwards.

18,004. Have you observed mortality among rats to precede mortality among human beings, in any case except the one which you have just specified?—I have observed it in all the three epidemics.

18,005. That is to say you have observed mortality in rats in individual houses to precede attacks among human beings in those houses?—Yes.

18,006. I presume that when you made these observations plague was existing in the neighbourhood?—These were in different streets.

18,007. Has plague been present within a mile of those streets?—Within half a mile. I have seen rats sicken where the plague cases occurred only among men; first men suffered, and then on the eighth or tenth day rats began to sicken.

18,008. What do you wish to say about aërial infection?—I believe that in stuffy rooms, where a pneumonic patient is being treated, the air becomes infected and the nurses and other attendants suffer from plague afterwards.

18,009. Have there not been in Bombay some very marked instances in which, although there has been pneumonic plague, the attendants in the hospital and also the relatives of sick persons in the hospital have escaped entirely?—Quite so. I put that down to disinfection, and free ventilation in the hospitals. The perflation of the air reduces the infection to a minimum, and I believe also the attendants and medical men in the hospitals get immune against plague in a certain time in some way.

18,010. You say that in two instances the attendants on parsons suffering from pneumonic plague rapidly got the disease?—Yes.

18,011. Is it not possible that they got it from the sputum of the patient?—In these two instances I think not, because these people were in separate rooms; they did not occupy the same room. They did so many hours in the room, then went to the next room, and passed the time there. Of course it is just a remote possibility they *might* have got it from the sputum as they knew the value of disinfection.

18,012. Have you any experience with Yersin's curative serum?—I only know two cases which were treated by Dr. Yersin's serum sufficiently early; the results were negative.

18,013. Have you inoculated any persons?—Yes, about 400.

18,014. Have you observed the effects of inoculation?—Yes. The action depended upon the dose I gave.

18,015. Have these 400 persons remained under your observation after inoculation?—No, not all.

18,016. Therefore you are unable to see how far they have been attacked by plague?—Yes.

18,017. Have any instances come to your notice in which persons were inoculated and subsequently got plague?—Yes, a few. Dr. Davar suffered from plague in December 1896; he was inoculated a few months afterwards, and subsequently suffered from plague and died. Dr. Dayar was a special officer working in the Kamatipura district.

18,018. Have you any other instances of persons who suffered twice from plague?—Yes. Mrs. Ezra suffered from plague at Hong Kong on the 24th July 1894, and on the 6th December 1896 she got a second attack in Bombay—Bellasis Road.

18,019. Did you attend her during the second attack?—Yes.

18,020. Did she recover?—Yes.

18,021. Have any other instances come to your notice?—Yes, one Narayan Mulji suffered from plague three times. I saw him the third time. The first time he was treated by Dr. Ismail Jan Mahomad.

18,022. When did you attend this Narayan Mulji?—In the second epidemic in July or August 1897.

18,023. What form of plague did he have?—Bubonic plague. The bubo was in the axilla accompanied with diffuse cellulitis.

18,024. Was that his second or third attack?—His third attack.

18,025. Will you give us the history he gave you?—He said he suffered first in 1896, when he had a bubo in the groin.

18,026. Who attended him then?—Dr. Ismail Jan Mahomad treated him the second time he had plague; that was in the second epidemic, about November.

18,027. Do you know who attended him the first time?—I do not know.

18,028. Did he recover from the third attack?—Yes. Then he was also treated by Dr. Ismail Jan Mahomad.

18,029. Is this man to be seen?—Yes, I think so.

18,030. Could you bring him here on the 20th?—I am sure he would be willing to come, because he offered himself, but I should like the Secretary to write to him; that might induce him to come. (Mr. Narayan Muljee was examined on February 20th.)

18,031. Have you any other cases of double attack?—Yes, a Customs' clerk suffered twice from the disease, the first time in November and the second time in April 1897.

18,032. Did you attend him on either occasion?—I saw him at the hospital; he was at the Lal Bag Hospital the second time.

18,033. Did he have bubonic plague both times?—The first time he mentioned to me that he had a bubo in the left groin. The second time I saw him, and the bubo suppurated, and he recovered.

18,034. Was the bubo in the same position?—I do not remember exactly.

18,035. Could you produce this man also?—I could not say that, but you could get the facts from Mr. Green, the Secretary of the Plague Committee. If you wrote to the Collector of the Customs you might get at that man. (The man in question, Mr. Champaklal Thakurdas, was subsequently examined on the 20th February).

18,036. Does that complete the list?—There are two more mentioned in my précis, but I am doubtful, because they might have been recurrences.

18,037. It is possible the disease was continued the whole time in one case?—I do not think so, because there was no rise of temperature, and the buboes had disappeared. It might have been a recurrence. I cannot say.

18,038. Have you observed any cases of mild form of plague?—Yes.

18,039. Can you describe the symptoms in these cases?—A man generally suffers from a small chill and headache in the front of the head; he then feels general *malaise*, pains all over the body and joints and small of the back. His temperature rises to about 100, and he is ill for a day or two and then he is again better.

18,040. Do these people go about their usual business while suffering in this manner?—Some do. There was a man named Mascarenhas, who lived at No. 18, Church Street. He had three days very slight fever, and on the fourth day a small shotty gland appeared; all the while he was all right, that is, he continued his work for three days, and on the fourth day the gland appeared, and on the fifth and sixth days his temperature was 100.

18,041. Did you attend him?—Yes; I showed this case to Colonel Wilkins.

18,042. When was that?—In October—the 6th to the 12th October 1898.

18,043. Can you tell us whether the cases with mild form of plague occurred mainly at the beginning, middle, or end of an epidemic?—Towards the end I saw people suffering from fever of a relapsing character, and then, afterwards, on the 14th or 15th day, they developed buboes; in one or two instances they died. On the other hand I have seen plague cases develop buboes on the third or fourth day, and then proceed towards recovery, and afterwards have the relapsing kind. It is a sort of mixture of the two. They had fever of the relapsing kind and a bubo appeared afterwards.

18,044. Have you observed this mild form occurring among young persons?—Young adults.

18,045. Not among children?—No; I have not seen them have it.

18,046. Do you think you could find any cases of it now?—Perhaps.

18,047. Will you try and find some cases?—Yes.

18,048. Do you think that inoculation is the chief means by which plague is caught?—Yes, through an abrasion or something of that kind.

18,049. Do you think that the practice of cleaning brass vessels with mud has anything to do with it?—From my observation in C Ward I found that in certain houses in the central street, Kumbarwada, the women suffered more from axillary buboes than men. Men suffered from femoral bubo.

18,050. The women are the persons engaged in cleaning the brass utensils?—Yes, in the mud-making operations.

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18,051. Do you think that explains the frequent occurrence of the axillary bubo among women?—Yes, I think so.

18,052. (*The President.*) Have you treated many cases yourself?—No. In the first epidemic I did treat a few.

18,053. Have you latterly seen many cases throughout the course of the illness?—Yes. During my tenure of office I must have removed over 1,000 to hospital. I have gone to hospital and seen them, but I have not treated them.

18,054. Were there many pneumonic cases among those you have seen?—Yes.

18,055. Have you observed in any case any swelling of the anterior part of the body?—I found dulness on percussion.

18,056. Did you see anything in the nature of œdema in the skin?—Yes, I could mention cases, and they had also bubo. For instance, Dr. Mehta, who attended the Banniah Hospital at Pinjgrapole, got plague, and had a diffuse swelling all over, anterior and posterior, so far as the lower angle of the scapula.

18,057. That is, on one side of the thorax?—Yes.

18,058. But have you seen anything like a general swelling of the whole of the anterior surface?—No. In cervical cases in children, where the buboes were in the neck, I have seen the swelling come down so far as the middle of the sternum.

18,059. In the cases of mild plague have you any instances in which they infected any other persons?—I could mention only one instance, but the second case in that instance, a woman, to my mind was not suffering from plague, but from fever. Mascarenhas had plague, I believe—he had a bubo in the right groin—and his mother suffered from slight fever which lasted three days.

18,060. She became affected afterwards?—Yes. Dr. Wilkins said the enlargement of the gland in Mascarenhas' case might have been due to other causes, but I could not find any abrasion, no cut, nothing on the foot, and I put that case down as one of mild plague.

18,061. The second case was fever?—Yes.

18,062. Then you have not seen any cases of mild plague infecting any other persons?—No, I have not.

18,063. (*Mr. Hewett.*) You have seen a good many of the people employed upon plague duty here?—Yes.

18,064. Have you noticed any of them with symptoms of plague, enlarged glands, or anything of that sort, without their actually getting plague?—Yes.

18,065. Is that common?—I think it is frequent among workers on the plague. Several times the glands get enlarged, especially the femoral glands, and then the enlargement passes away.

(Witness withdrew.)

Mr. A. H. Simcox, I.C.S., called and examined.

Mr. A. H. Simcox I.C.S.

18,066. (*The President.*) You are in the Indian Civil Service?—Yes.

18,067. You are Assistant Collector of the Malegaon sub-division of the Nasik district?—Yes. Malegaon is a large town of about 20,000 to 25,000 people. It also has another village which, although not included in the Municipal limits, is practically a part of the town: it is separated by a river which is nearly dry.

18,068. When did plague appear there?—The first known case was on the 11th November 1897. I do not think there was anything before that, because I traced the infection directly to an old woman who sneaked in from Bombay.

18,069. It was imported from Bombay?—Yes.

18,070. What measures did you adopt?—I was out in the districts. I got back the next day, and we took immediate steps. We got a large dharamsala for a hospital, and segregated the cases as they occurred. There were two other cases on the first day. The Municipal people suspected it on account of their having been three deaths very close together. The old woman died and two other people died at the same time in the same house. At that time there was only a native Hospital Assistant there, and I am sorry to say that I suspect he took bribes; we only got one or two declared cases a day at that time, all in the same neighbourhood. We began by clearing out the house in which a case occurred and the two houses on each side. After some time we built regular lines of huts for contacts and for the cases, for the people who nursed the patients and the contacts, and the people from the neighbouring houses. We got into regular swing, but never succeeded in stamping out the disease with this partial evacuation, which lasted from 12th November till the 19th January.

18,071. In that period how many plague cases occurred?—About 350.

18,072. You were not satisfied with the success of this measure?—No. On the 5th January we got 18 cases, our maximum for one day.

18,073. Besides this partial evacuation, did you disinfect the houses?—Yes, we disinfected all houses which were evacuated.

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18,074. When did you adopt complete evacuation?—On the 20th January I issued a notice that all the town was to turn out, in four quarters, allowing one week for each quarter, but it really came to three weeks, because towards the end the last two quarters went out together. They were all out on the 10th February. I got them into the maidan, about a mile from the town, where there was a dharamsala, a big rest-house for travellers, built of stone. I would not allow the people to go anywhere else but into certain lines. We made lines in the fields like a military camp, and gave each man so many square feet for building his own hut on, and made lanes between. We got the whole town out in this place. The population had largely diminished. A great many people ran away at first, but I reckoned I had about 12,000 people in the camp.

18,075. How many cases occurred after this complete evacuation on 10th February?—After that we had one or two cases. Almost all the population are weavers, and we put up the strongest huts we could to support their hand-looms, but we found we could not completely satisfy the people's requirements. They lived from hand to mouth by their daily weaving, and I had to select a certain number of large weaving shops in the town—not living houses—disinfect them, and let the people go into them in the day-time. There were a few cases of those people stealing into their houses at night, and it was among them we had further cases of plague. We did not have a single case which could be proved to originate in the health camp.

18,076. Do you know where the people who fled from the town went to?—Perfectly. I had a complete watch kept on all the country round, and I can practically tell you where every man went to. None of them went far away.

18,077. Did they convey the infection to anybody else?—No, not a single village was infected.

18,078. That disposes of the 25,000 people, does it not?—Yes. Each village in this country has a large area of fields belonging to it, and by far the greater number of people were within Malegaon boundaries.

18,079. How long were the people kept out?—We let them in again on the 2nd April.

18,080. Previously to that, what had you done to the evacuated houses?—I had disinfected every house all through the town, the greater portion with perchloride solution, according to Government orders. There was a man in the town who wanted to get rid of a lot of sulphuric acid, so I wrote to Dr. Hay, and got the opinion of the Surgeon-General that sulphuric acid, 1 in 500, would do instead of perchloride. Then I bought some sulphuric acid and did a certain number of the houses with that. We have not had a case since. The people have gone back, and there has been no recrudescence.

18,081. Are you free now?—Yes.

18,082. What was the effective measure which you adopted, in your opinion?—Turning out the town. Towards the end of our partial evacuations we turned out the whole block in which there was a case. Some people were bound to get into the neighbouring houses where they had relations. We found a great many dead and dying rats also.

18,083. Partial evacuation did not succeed?—No.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

FORTY-EIGHTH DAY.

Wednesday, 15th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Lieut.-Col. W. G. H. Henderson, I.M.S.

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Lieut.-Col. W. G. H. HENDERSON, I.M.S., called and examined.

18,084. (*The President.*) You are in the Indian Medical Service?—Yes.

18,085. You are prepared to give evidence on the outbreak of plague in Hyderabad, Sind?—Yes.

18,086. (*Mr. Hewett.*) When did the first imported cases occur in Hyderabad?—The first imported cases occurred in Hyderabad in the first week of January 1897, shortly after the appearance of plague in Karachi.

18,087. How many imported cases were there before the disease became indigenous?—There were 34 or 35 imported cases.

18,088. When did the first local case occur?—In the last week in February.

18,089. So that there was an interval of about seven or eight weeks?—Yes, between the first imported case and the appearance of the plague locally.

18,090. After the indigenous cases began to occur, how long did the disease prevail?—After the local cases, until the end of July.

18,091. Can you tell us how many cases there were during the whole time?—Roughly speaking, just under 600.

18,092. Have you any idea of the proportion that died?—There were 400 treated in hospital, and 35 per cent. of these recovered.

18,093. Was the prevalent form pneumonic or bubonic?—Bubonic.

18,094. Were there any pneumonic cases?—There were what I thought pneumonic cases, but in several of these there were buboes as well.

18,095. I suppose you had no opportunity of observing whether a bubonic case gave pneumonic plague to another person?—No, I could not state that.

18,096. Did you find any instances of *pestis minor* or of the non-typical forms of plague?—Of those which had very slight symptoms, and which really suffered at all there were some cases, and I think there were some in the town, but we did not discover all who actually suffered from plague.

18,097. About how many of those cases came under your observation?—About 20 of them. They were really very mild cases; they came into hospital and rested there and recovered.

18,098. Did they have high fever?—No, they did not. Their temperature was never above, perhaps, 100 or 101.

18,099. Were they prevented through personal incapacity from doing their ordinary business?—They were incapacitated from doing their ordinary business, so far as the people in the town refused to have anything to say to them.

18,100. I mean physically incapacitated?—They were not physically incapacitated; they might have walked through the plague.

18,101. How long did the fever last in the case of these people?—For a week or 10 days. I had no reason for detaining them longer.

18,102. Did you find these cases more at the end or at the beginning of the epidemic?—More at the beginning.

18,103. Did you observe that they occurred among any particular class of persons, according to age?—They occurred among young adults.

18,104. Not among children?—There were some cases among children, but the ones that I recollect most were among the young adults.

18,105. After the imported cases, did you observe mortality among rats?—Yes.

18,106. That was subsequent to the arrival of the imported cases?—Yes, and immediately prior to the occurrence of local cases.

18,107. What inference do you draw from that?—That the rats were infected by the imported cases, and when they were infected, that they infected the locality; and that the infection of the locality was the means of infecting others.

18,108. Have you anything you would like to say regarding the manner in which people get inoculated with plague?—I have looked to the prevalence of fissures and cracks and wounds, and although there are some cases in which these occurred, the numbers were not sufficient to let me draw any decided inference from it. Although it is merely a supposition, my idea is that on a locality becoming affected, the people living in it, and eating in it, and cooking their food in it, may be affected through these means; especially through the food. I have seen people in infected localities sitting on the floor, and eating their food virtually off the floor itself, and I think if the locality is so seriously affected, as I am sure it was, that this may be a means of propagating the disease.

18,109. Have you anything more definite than the information that you have just given us, regarding intestinal infection?—No, nothing more.

18,110. Has it come under your observation that rats and mice fed on cultures or infected food have developed plague and died?—No. That is what I have been told by a bacteriologist.

18,111. Do you think it possible that the dust flying about in the air communicates the disease?—I think it possible that it may produce the pneumatic form of disease.

18,112. Do you think it possible that the custom of the females in this country of cleaning their cooking pots with mud might tend to give them plague?—I think it might decidedly have a tendency.

18,113. Do you think that the practice of the people after they have performed the necessities of nature is likely to give inoculation?—I have not thought of the inoculation being propagated in that form.

18,114. What is the population of Hyderabad?—65,000.

18,115. What proportion of the 65,000 left the town between the date of the imported cases and the occurrence of the local cases?—The population was increased rather between the 1st January and the latter week of March because the people still flocked up from Karachi to Hyderabad.

18,116. After the plague began to be indigenous at Hyderabad did the population remain at its normal figure, or did it decline at all?—It declined to a certain extent, but not to a very great extent, as we took these very stringent measures to prevent the people flocking to the districts unless they had been under observation.

18,117. You think that the whole number of the population were dealt with?—Yes, except that numbers did go that were allowed to go.

18,118. When you evacuated the town how many people remained who were not provided for in the camps?—About three-quarters of the population left, I should say, the most congested parts of the city.

18,119. Were they all taken charge of in camps, or were they allowed to hut themselves?—They were allowed to hut themselves under supervision.

18,120. Were they allowed to go back to the town?—They were allowed to go back to the town for business purposes, but even there they were under supervision.

18,121. Could you give us a statement showing how the plague declined week by week after you got the people out of the town?—(Witness subsequently intimated that the Collector of Hyderabad, on being asked for the figures, stated that no reliable information could be supplied.)

18,122. Did you carry out disinfection on a large scale?—Yes, we carried out the disinfection of houses on a large scale.

18,123. Did you disinfect only those houses in which cases of plague were known to have occurred?—No, we disinfected houses in the quarters which were infected.

18,124. Did you have any means for disinfecting the clothes of people that went into the segregation health camp?—Only boiling.

18,125. Did you have any cases of plague in the health camp?—19 cases in the contact camp and eight or nine cases in the other camps.

18,126. Are you of opinion that plague is conveyed by means of the infected clothing of plague patients?—I think it is.

18,127. Did any instance come to your notice of plague being conveyed by clothes alone without personal contact?—By clothes taken from an infected person, yes. In some of the villages of Hyderabad, in the district, I think that the clothes were the means of infection.

18,128. The facts that came to your notice showed that?—Yes.

18,129. Can you give us the particulars of that?—In the village of Allahyar I think the infection was carried by clothing, especially because in that case the large percentage of the people who went there had been kept under observation. Of course, some may have escaped, we cannot say that. Our disinfection of clothing, as it was simply boiling, was very inconvenient for the people, and they tried to elude it as far as possible, and although we kept a strict observation, I have no doubt that some clothing was taken away, in fact I am certain it was, to this village, and that the clothing was the means of infecting some of the people.

18,130. How do you think that the clothing of patients who suffered from bubonic plague got infected?—Either from the discharges from the bubo, or from the excreta, or from the sputum.

18,131. You think from sputum in bubonic cases?—Yes; but in the pneumonic form especially.

18,132. Did you have corpse inspection?—We had corpse inspection in Hyderabad when plague was prevalent at Karachi in the second epidemic, and at Kotri, which is just across the river from Hyderabad, during the epidemic there.

18,133. Did the people show any objection to it?—No, not at all; they were entirely with us, I think, after the first flight of the plague in the first scare, and they helped us in every way that they could.

18,134. Who examined the female corpses?—A lady doctor.

18,135. Do you think you can ascertain by the examination of corpses whether pneumonic plague is present or not?—I do not think so.

18,136. Have there been any other cases of plague since the epidemic ceased in July 1897?—There have been no local cases in Hyderabad or in the district.

18,137. Was the town of Kotri infected three or four months afterwards?—Yes.

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18,138. Does it lie immediately on the other side of the river to Hyderabad?—Immediately opposite, on the other side of the river.

18,139. Has any further infection come from Karachi?—Cases have come, but we discovered them at once, and we put them into the camps so that neither from Kotri nor from Karachi had we any other infection of localities.

18,140. You have had particularly favourable opportunities for stopping people, have you not, by means of the camp at Malir?—Very favourable indeed. There were only a very few cases escaped the camp, and occurred in Hyderabad during the Karachi epidemic.

18,141. Have you any information about inoculation?—No, I have no information about inoculation. We did no inoculation at Hyderabad, except in a few cases.

18,142. Have you anything to say as to the effect of climate on plague?—I think that we were helped considerably in Hyderabad by the very hot and the very dry climate there, and the nature of the soil which is rocky and sandy.

18,143. Did you find that the disease declined as the temperature increased?—From the first the temperature was very high. In March, the temperature goes up to 115 and 120, perhaps not as high as that, but in April the temperature is as high, probably, as it is in June and July.

18,144. Then your experience in Hyderabad is contrary to the opinion which some people have held that very high temperature will destroy the plague?—Well, it did not last very long in Hyderabad.

18,145. But did not the epidemic actually grow in Hyderabad when the temperature was at its highest?—From April, May, and June, the weather was very hot indeed, and the plague rose and declined during that time.

18,146. (*The President.*) From these cases of mild plague, did it come under your observation that any other persons were affected?—From my experience of my hospital, I think that the person to person infection is very rare indeed. I think that it is the locality which is the cause of the infection.

18,147. You did not observe any cases?—No.

18,148. What exactly were the symptoms of this *pestis minor*?—There was *malaise*, a feeling of indisposition and loss of appetite, and in some cases a small bubo which did not suppurate.

18,149. And a rise in temperature?—And a rise in temperature to 100 and 101.

18,150. Were there any bacteriological observations made?—I made none.

18,151. Are you aware of any having been made?—I am not a bacteriologist, and we had no means of making them at all.

18,152. Did you follow the course of any patients after you treated them?—Not after I treated them.

18,153. You had a considerable number of pneumonic cases?—No, not a considerable number; it was rare in Hyderabad.

18,154. How many do you think you saw?—I forget the numbers; there were very few.

18,155. Were they very fatal?—Yes, very fatal.

18,156. Did you see many of them shortly before death?—Yes, shortly before death.

18,157. And did you see their corpses afterwards?—Yes.

18,158. Did you observe in any of these cases whether there was any swelling in the anterior wall of the chest?—No. In some cases there was swelling in the walls of the abdomen.

18,159. Do you mean of the actual walls, or of the whole abdomen?—Of the whole abdomen.

18,160. Not restricted to the muscle or skin?—Not so far as I could make out restricted to the skin or muscle; there was a tenseness of the whole abdomen.

18,161. There was no œdema?—There was no œdema.

18,162. You speak of certain cases occurring in the contact camps?—Yes, in the camp where those actually in contact with the sick were located, or who came from houses in which cases had occurred. These were put into a separate camp.

18,163. There were a few cases in the health camp?—They were fewer than in the other camp.

18,164. Did these cases in the health camp originate some time after the patients had been segregated in these health camps?—All within 10 days.

18,165. They might have been infected in the town before that?—Yes, they might have been infected in the town.

(Witness withdrew.)

Mr. K. B. Shroff.

Mr. K. B. SHROFF called and examined.

18,166. (*The President.*) You are acting as Deputy Health Officer here?—Yes.

18,167. To what places is your evidence in reference?—Malabar and Cumballa Hills.

18,168. I believe you also wish to speak of some other place?—Yes, Cutch Mandvi.

18,169. You followed the course of plague in Cutch Mandvi?—Yes.

18,170. When did it first appear there?—We were sent there on the 27th of April 1897, and I was there for 2½ months along with Dr. Wilkins and Dr. Mason.

18,171. When did the plague commence?—The plague had commenced about a month previous to our going there.

18,172. You do not therefore know much about its introduction?—No, nothing positive.

18,173. You have formed some opinion in regard to the communication of plague?—Yes.

18,174. Will you state your opinion?—I think plague was communicated in three different ways. First by the air, causing the primary plague pneumonia, which is very infectious. The second is by the rupture or abrasions of the skin, which might account for so many cases of buboes in the groin. We find almost all the poor classes, and all the servants, going about with naked feet, and they might have imperceptible abrasions between the toes, and that might also account for the great majority of people getting buboes in the groin.

18,175. Did you find many abrasions; did you search for them?—Yes.

18,176. Do they represent a large or a small proportion of the total cases?—A great many of the cases.

18,177. What kind of abrasions, and where were they chiefly?—Between the toes; there was a slight rupture of the superficial layer of the skin. We cannot find it unless we widen out the toes, and then we find a rupture of the superficial layer of the skin between them.

18,178. Assuming the virus enters one of these lesions, were there any local signs distinguishing them from other lesions? Was the actual lesion modified in any way?—No.

18,179. There was no inflammation or swelling?—No inflammation; nothing whatever.

18,180. You merely infer that the virus had thus entered because there were lesions?—Yes.

18,181. Did you find corresponding lesions to account for buboes in the axilla?—No.

18,182. Did you search the hands?—Yes.

18,183. How do you account for buboes in the axilla?—There might have been, but we did not find any.

18,184. And in the case of enlargements of the neck glands?—There we did not find any either.

18,185. Then, how do you suppose the buboes were caused there?—There was a case of a man who complained of caries in the tooth, and subsequently there was a bubo in the neck.

18,186. On which side?—On the corresponding side.

18,187. You have one case of that description?—Yes, one case recently. The patient was suffering from caries of the tooth, and after three or four days the man died, and there was swelling on the corresponding side of the neck.

18,188. You mentioned a third method of communication; what is that?—Propagation by rats.

18,189. What are your observations with regard to propagation by rats?—Last year the plague came on in Malabar Hill, and previous to that we had reports of dead rats found in all the servants' quarters, and in spite of the warning given to the servants not to sleep in those quarters, they persisted in sleeping there, and within a week we found a case of plague in those servants' quarters.

18,190. Where dead rats had previously been found?—Yes. Although the quarters were disinfected, and I had warned the owners not to allow the servants to sleep in the room, they persisted in sleeping there, and within a week I found dead persons, and cases removed. Most of those bungalows were on the seaside, and I think that the rats travelled from the drains to the foreshore.

18,191. From where did these rats travel by drains?—From the infected parts.

18,192. What would be the nearest infected parts?—Khetwadi, Girgaum, Tardeo, and other places.

18,193. Quite near?—Yes.

18,194. Have you any other observation?—We had one bungalow on the other side of the Hill where we had three cases, and dead rats were found for two or three days consecutively.

18,195. Before or after the cases?—Before the cases occurred.

18,196. How long before?—Ten or 12 days, not more than that; and the butler who was a very robust and strong man said he was very bold, and he persisted in sleeping in those rooms where the dead rats were found. After three or four days he was found lying in the compound quite helpless, with a bubo.

18,197. That was one case?—We had numerous cases like that.

18,198. How do you think rats actually communicated the plague to these patients?—I believe that rats brought the infection with them, and the germs were lying in the room.

18,199. And they infected the room?—Yes, and although we took all possible precautions to disinfect, still the cases occurred in these rooms.

18,200. Have you followed the progress of many cases of plague yourself, from the commencement to death, or recovery?—Many cases, but I had no opportunities of seeing the patients after their removal to hospital, except to Cutch Mandvi, where about 2,000 cases passed through my hands.

18,201. Did you inquire into their histories in most cases?—We had hardly any time to go into the history of all these cases. They were brought into the hospitals in a moribund condition—and we had great difficulty—we had no staff in the beginning, and we had to organise the whole thing ourselves after we reached Cutch Mandvi.

18,202. Did you see among these cases many pneumonic cases?—Yes, many pneumonic cases.

18,203. Did they occur throughout the epidemic, or at any particular part of it?—I think it was most prevalent at the time we went there in April.

18,204. Was that some time before the epidemic ceased?—In the middle of the epidemic; when we went there of course the decline commenced by seven to ten every week.

18,205. Was that after evacuation?—After evacuation, segregation, and disinfection; the whole town was evacuated.

18,206. Have you any facts to show whether a pneumonic case might obtain infection from a bubonic case?—I cannot say that.

18,207. Or *vice versâ*?—I cannot say. The pneumonic type gives infection.

18,208. Have you any cases?—Yes, we have.

18,209. Could you illustrate you answer by instances?—I can give three instances. There was one, a Hospital Assistant, who was suffering from the pneumonic type of the disease. Subsequently to that we had two persons who were attendants on this man who got plague and died.

18,210. What form of plague was it, pneumonic or bubonic?—Pneumonic.

18,211. Have you any other cases?—Altogether there were nearly ten cases from this one case of pneumonia.

18,212. Will you explain how they originated?—There were four attendants, two friends, and three or four other friends who accompanied the corpse—ten altogether.

18,213. Can you follow up the histories of these ten, and determine whether they were pneumonic or bubonic?—I find that these ten cases were of the pneumonic type. Then there was another case in another chawl. A lady died of pneumonic plague, and one of her relatives who attended her died of pneumonic plague, and a third also died of pneumonic plague—three altogether.

18,214. Do you recollect any case in which a pneumonic case produced bubonic plague, or a case in which bubonic plague produced pneumonic?—Yes, I had a case a few days back. One pneumonic case I removed to the hospital, and subsequently there have been two other cases both bubonic, in the same house.

18,215. What was the means of contact between these cases?—They were lying in the same room, and one was lying along with the patient. He was his uncle and the other was his friend. He only visited him, and did not reside in the same room. The man only died yesterday, and he had a bubo in the neck.

18,216. These were all the cases which occurred in connection with this case you have mentioned?—Yes.

18,217. You have had some experience with curative serum, have you not?—Yes.

18,218. Would you describe your experience?—When I was in Cutch Mandvi we had nearly 30 cases inoculated with Dr. Yersin's serum, and out of these only 11 recovered.

18,219. Did you take charge of the patients in these cases in which curative serum was employed?—Yes, I myself inoculated them.

18,220. Were you following the history of these cases?—Yes, with Dr. Mason.

18,221. You were doing it in conjunction with Dr. Mason?—I was under Dr. Mason, and I was in charge of those wards.

18,222. There is a clinical record of these cases?—Yes, but I differed from Dr. Mason in some of the cases he put down as plague. I took them to be malarial fever. That is the reason why I give 11, and I believe that Dr. Mason has shown a higher figure. Dr. Mason's theory was that these were plague cases that were inoculated with Dr. Yersin's serum, and who subsequently recovered, but my opinion was that they were malarial cases.

18,223. How many cases does this apply to?—I have no figures.

18,224. Were they a small or a considerable number?—Only a difference of two or three.

18,225. It does not affect the general result?—No.

18,226. What is your opinion of the value of Dr. Yersin's curative serum?—I do not think it is of any value; I am against it.

18,227. You had experience also of preventive inoculation?—Yes, I inoculated 1,242 persons up to the 12th instant, of which 999 were for the first time, and 243 for the second time.

18,228. At what period of the epidemic was this?—Since the last 14 months.

18,229. What was the result of your inoculations on the whole?—I have no case with any bad after effect, excepting one case after the second inoculation, where there was severe purging, vomiting, fainting, and urticarial rash lasting for about an hour-and-a-half.

18,230. In so far as you can estimate the value of the inoculation in preventing plague, what was your opinion?—I think it was a great safeguard.

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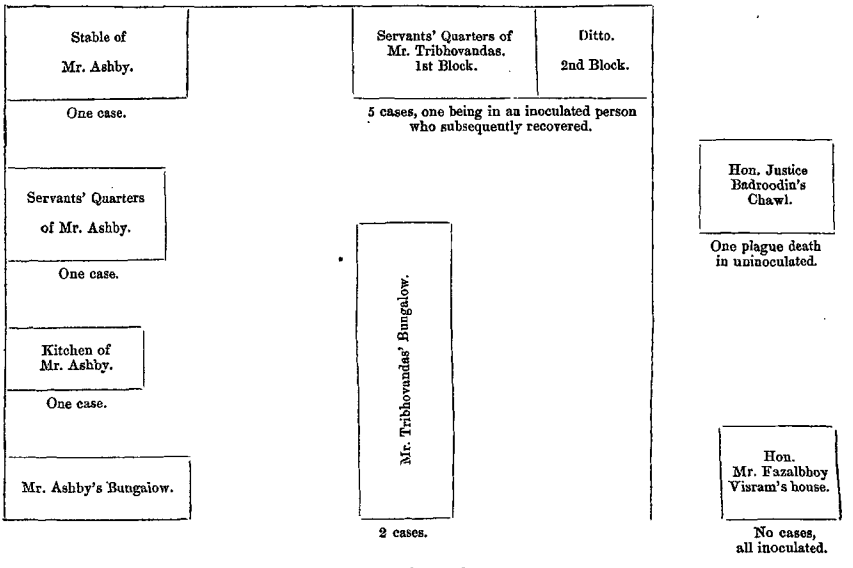
18,231. Have you got any facts and figures which support that view?—Yes. In Warden Road, just near the Battery, there is a big compound containing three bungalows; behind these, and separated only by a 6 foot wall, there are two chawls, and two other bungalows, and adjoining those again there is another bungalow, and servants' quarters. In the front bungalow, containing altogether 75 servants, only one man was inoculated. Here there were altogether 11 cases of plague, including the one inoculated, who subsequently recovered. This man was inoculated on 30th January 1898, and got plague on 10th March 1898, *i.e.*, 40 days after.

18,232. The only man who was inoculated also acquired plague?—Yes, 40 days after inoculation; he subsequently recovered in the hospital, but died later on of some other disease.

18,233. How long afterwards did he die?—About two months after his discharge from the hospital. Behind these bungalows almost all the people were inoculated, and here there was only one case amongst the uninoculated who subsequently died. In the neighbouring house all the servants were inoculated, and there was no other case there. I have a sketch here which illustrates it, as follows:—

A ROUGH SKETCH of the POSITION of the BUNGALOWS in WARDEN ROAD near the BATTERY.


Stable of Mr. Ashby.
One case.
Servants' Quarters of Mr. Tribhovandas. 1st Block.
Ditto. 2nd Block.
5 cases, one being in an inoculated person who subsequently recovered.
Hon. Justice Badroodin's Chawl.
One plague death in uninoculated.
Servants' Quarters of Mr. Ashby.
One case.
Mr. Tribhovandas' Bungalow.
Kitchen of Mr. Ashby.
One case.
Mr. Ashby's Bungalow.
2 cases.
Hon. Mr. Fazalbhoy Visram's house.
No cases, all inoculated.
Warden Road.

18,234. Have you any statement which shows the results in all the cases you inoculated?—No, I have only two or three instances.

18,235. Are these selected instances?—Yes.

18,236. You cannot tell me the result regarding the whole of these 1,242 persons, as to who acquired plague afterwards?—No, I cannot say that, but most of them reside in my ward, and I would have known about it if they had acquired plague.

18,237. Supposing they went away from your ward?—Then I could not trace them, but in that case the other wards would be making inquiries about them.

18,238. It is just within the bounds of possibility that you would have heard?—Of course I could not be positive about it.

18,239. (*Mr. Hewett.*) Do you think that the practice of using earth for the purpose of cleaning cooking utensils and other things may lead to people being inoculated on the hands with plague?—Yes, it might.

18,240. Have you noticed any difference in the proportion of males and females who get plague?—I find a greater proportion of females than males. I found the same thing in Cutch Mandvi also, not a very great proportion, but a little more than in the males.

18,241. Did you notice whether the buboes in the case of females were generally femoral or not?—They were mostly femoral.

(Witness withdrew.)

Mr. K. A. Dodihalkar

Mr. K. A. DODIHALKAR called and examined.

18,242. (*The President.*) You are a Licentiate of the College of Surgeons, Edinburgh?—Yes.

18,243. (*Mr. Hewett.*) Are you employed in the Health Department in the Byculla Division of the town?—Yes.

18,244. Are the inhabitants of that chiefly Hindus or Muhammadans?—Half Muhammadans and half Hindus.

18,245. Is it a poor district?—Yes, a very poor district.

18,246. Is it very congested?—Yes, very congested.

18,247. Has plague been very bad there?—Yes.

18,248. Is it very bad there now?—Yes.

18,249. What is the population of the Division?—50,000.

18,250. How many cases of plague occur there now daily?—At present, I believe, it comes to nearly 25 a day.

18,251. Are they mainly pneumonic or bubonic?—Mainly bubonic.

18,252. Have pneumonic cases come under your observation too?—Yes, they have.

18,253. Have you ever noticed any case in which a patient suffering from bubonic plague has communicated pneumonic plague to another person?—I have not traced it, but one person in the same house

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has got pneumonic plague while the other persons have had bubonic plague.

18,254. Have you had many instances of that?—No, very few.

18,255. Do you think that you get the majority of plague cases now?—Yes, we do.

18,256. Do the people report them?—The people do not report so much.

18,257. But you find them out yourself?—They are found in the cemetery, by the extra number of deaths.

18,258. Then you find them after the people are dead, not while they are sick?—Not while they are sick.

18,259. Do the people object to go to the hospital?—They do.

18,260. I see that you say in your précis of evidence that if you can assure them of their recovery they would go; that is rather a difficult thing to do, is it not?—They do not see the recoveries, and they do not like to go; they are ignorant people.

18,261. Do they object to going to segregation camps?—Yes.

18,262. What is their objection?—They are put to great trouble in removing their luggage and baggage, and at the same time they say that these huts will take fire at any time, and there is no certainty about their safety.

18,263. Are you at present employed on plague work?—No, I am on sanitation work.

18,264. On what sanitation work?—The removal of filth from the streets and houses, getting the w.c.'s cleaned, and, where the houses are dirty and insanitary, giving notice to the landlords to improve them.

18,265. Are you employed on disinfection only?—Not at present. I was last year.

18,266. (*The President.*) You said that when the houses are insanitary you give notice?—Yes.

18,267. Who is the judge of whether the houses are insanitary or not?—I am.

18,268. On what grounds do you proceed?—If the houses are dark and have no means of light, no windows, no ventilation, if they are damp, and the walls dirty, then I give notice to the landlord.

18,269. Do you give notice yourself directly, or through some other official?—I write to the Municipal Commissioner through the Divisional Health Officer.

18,270. Have you had occasion to give such notice in the case of a large number of houses or not?—I have.

18,271. In how many instances, roughly, have you given such notices?—In the last two years I have been working with the Health Department, and I may have given about 1,000 notices.

18,272. Have you any recollection as to the number of instances in those 1,000 in which sufficient action was taken as the result of your notice?—Some houses are demolished, and in some houses windows are made to admit more light and ventilation.

18,273. In what proportion of the 1,000 has action been taken?—About one-fifth.

18,274. What has happened to the remainder?—Their cases have been referred to the Engineering Department, and action will be taken in due course.

18,275. In regard to the insanitary conditions, to what extent do you take notice of overcrowding?—We do not take any steps to remove overcrowding. May I mention a few of my ideas with regard to the origin of plague?

18,276. So far as you have got facts, we shall be very pleased to hear them?—In the year 1893, I was living in the Main Road in Khetwadi. My cat got a bubo on the neck which suppurated after one month, and the cat recovered. I was not aware of plague at that time, and I did not try to find out what it was. In the same month my brother got a bubo in the axilla, with high fever of 105 degrees. The fever was continuous for about a month, and then the bubo suppurated, and discharged the pus; he recovered, and he is living now. At the same time there was a little child about four years old living in front of my house. He had a small inguinal gland, with very slight fever, about 100 degrees, without any treatment it disappeared. I lay these facts before you to show that plague is not new in Bombay, and in India; but it is one of the old diseases, and the present severe form is only a new type. In Malad, a place about 30 miles from Bombay, the people are quite aware of this disease, they call it rat fever, and they describe it like this: that the rats fall from the roofs dead, and then if the people live in the house they get the fever themselves, and they die.

18,277. When did this happen?—About 15 years back. I do not know myself, but friends of mine who have been in Malad told me of this.

18,278. Do you know whether this rat fever is now present in Malad?—It is not now. 10 or 15 years back it was there, and they get it every 10 or 15 years; it is a very marshy place. About the first of this month one instance occurred. In my neighbourhood there is an institution called the Gouraki Press. There were some rats found dead in the compound, and there were two white rats that were kept in a cage in the institution for amusement. They died one after the other, and then one of the compositors got plague, and he was removed to the hospital and died there. This fact I want to place before you to show that it is not by contagion, it may be by infection, but the rats themselves got the disease in the vitiated air.

18,279. These rats were in a cage?—Yes, I went there every day, and I used to notice them.

18,280. Where was the cage?—It was on the roof.

18,281. It was sometimes taken down?—Yes, at dinner time.

18,282. Were the rats allowed to come out of the cage sometimes and run about?—No, they only placed the cage near the dish and gave them food.

18,283. Were there any cases of plague in human beings in this house or room?—Last year there was a case of plague.

18,284. I mean at the time?—Yes, one person got plague and was removed to the hospital.

18,285. At the same time or previous to the rats?—Previous to the white rats, but some rats had been dead before.

(Witness withdrew.)

Mr. K. S. Engineer.

MR. K. S. ENGINEER, called and examined.

18,286. (*The President.*) I believe you are a medical man?—Yes.

18,287. What are your qualifications?—I am a Fellow of the Chemical Society, London, and a Licentiate of Medicine and Surgery of the Bombay University.

18,288. What has been your association with plague?—As a medical practitioner.

18,289. You have no official connection?—No, only private connection with plague cases.

18,290. You come here as a private practitioner to give us your experience of plague?—Yes.

18,291. I think you have some opinions as to how plague entered Bombay?—Yes.

18,292. What are your opinions?—My opinion is that plague was imported into Bombay from Hong Kong.

18,293. On what grounds do you hold that opinion?—Because plague first occurred over those parts where articles of merchanise are landed from Chiua.

18,294. What is the connection with China?—At that time plague was raging in Hong Kong.

18,295. When did the first case of plague come under your observation?—On the 16th of July 1896

18,296. Could you give us some account of that case?—A Parsee gentleman, a Dubash, *i.e.*, a stevedore by occupation, brought a Hindu Superintendent (muccadum, *i.e.*, overseer of coolies) to me who was working

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on the Port Trust Estates. The patient was suffering from high fever, and when I examined him I found a bubo in the left groin. Of course, at the time I could not decide whether it was a real case of plague or not; but subsequently from the observation I made, and from the experience I gathered, I can now safely vouch that the case I treated was one of plague.

18,297. How did that case originate?—The man came to me and told me that he was working somewhere near the docks, and had got a high fever, accompanied with chills.

18,298. Were there any similar cases at the same time?—On that very day I had none.

18,299. How soon afterwards did you see cases of a similar kind?—After a fortnight a similar case occurred.

18,300. Were these identified as true cases of plague?—The symptoms in both the cases were different. This second case was a pneumonic case. This case was seen with me by the late Dr. Manser. We treated it as pneumonia. Now, however, I have come to the conclusion that this case which I saw in consultation with Dr. Manser was a pneumonic case.

18,301. On what grounds have you come to that conclusion?—The pneumonic symptoms differed. They puzzled us at the time.

18,302. What difference?—The pneumonic symptoms were gradually running; they did not appear all of a sudden. When I saw the patient I found slight congestion at the left base—it was a left pneumonic case. When I inquired into the history of the case, from the symptoms one could not conclude that it was a typical pneumonic case—it was not a typical case of pneumonia; the sputum was not free, it was very scanty, and not rust coloured, but accompanied with blood. The symptoms merged suddenly, in such a way that we wondered whether it was a real pneumonic case or not. We found out subsequently, however, that it was a real pneumonic case.

18,303. You had definite symptoms of pneumonia?—Yes.

18,304. What definite symptoms?—Dullness at the left base, accompanied with tubular breathing, and increased voice sounds, and crepitations. This case lasted three days. The symptoms merged according to the grades—from one grade to another.

18,305. The patient was ill for three days?—Yes.

18,306. Did the patient die, or did he recover?—He recovered in three days.

18,307. But these symptoms were sudden?—Yes, the stages merged from one to another in such a way that we could not decide whether it was a real pneumonic case or not. I have come to the conclusion now that it was a pneumonic case.

18,308. At the time you had no evidence that it was a pneumonic case?—On the first day there was no evidence of pneumonia.

18,309. The whole time you saw this patient you were not satisfied that the symptoms pointed to pneumonia?—No.

18,310. But now you think they probably did?—Yes.

18,311. State why you think so?—To my mind it seems to me that it was a pneumonic case—only from the conclusive symptoms.

18,312 They appear to be inconclusive?—The symptoms were inconclusive in the beginning, but conclusive in the long run.

18,313. In what way conclusive?—In ordinary pneumonic cases the symptoms run from one grade to another, but in this case the symptoms were sudden, and disappeared all of a sudden.

18,314. Did you have any bacteriological examination?—No, we did not suspect anything.

18,315. To my mind it looks doubtful whether it was plague or not?—I have seen lots of cases, and I have now come to the conclusion that it was a case of plague pneumonia.

18,316. There is nothing more than you have stated?—No.

18,317. I believe you have some statement to give us with regard to the chief factors which propagate the plague?—Yes; there are three factors. 1st. Overcrowding; 2ndly. Increase in the sub-soil water; and 3rdly, Bad drains. These, in my opinion, are the factors which cause plague to flourish.

18,318. What evidence have you which enables you to say that overcrowding causes plague to flourish?—Because in overcrowded districts we find cases occurring.

18,319. Will you give us some facts?—Supposing a family occupies a room 4 feet by 6 feet, there may be 10 or 20 persons there. If a plague case were to occur there, the other members would be found to suffer as well.

18,320. Have you any examples of that?—I have seen many.

18,321. Will you state them?—I know the case of a Parsee who was sick with plague. He occupied a very small room, and he had three children by his side. He died. The next day his son was attacked, and he recovered after a time. But in that very room, within a period of a week or so, three patients were affected with plague.

18,322. How many people occupied this room?—Five.

18,323. Were they all affected?—Out of these five three were affected. They were removed from the locality. Wherever there is overcrowding we meet with many cases.

18,324. Does your experience embrace an overcrowded district as well as an overcrowded house?—Yes.

18,325. Can you illustrate that by the case of Bombay?—Of course, Bombay is an overcrowded place.

18,326. But the proportion of overcrowding differs in different parts of Bombay, does it not?—Yes.

18,327. What do you consider the most overcrowded district, and has plague been most prevalent there?—Mandvi, in my practice, I find.

18,328. Is that the most overcrowded district?—I should think so. I call Mandvi an overcrowded place.

18,329. I asked which was the most overcrowded district; are all the districts overcrowded?—I should say Dongri and Mandvi are the most overcrowded districts in my practice.

18,330. Is it within your knowledge that the largest percentage of cases to the population has occurred in these two districts?—I cannot give you the exact ratio.

18,331. Is it within your knowledge or not?—I cannot tell you.

18,332. You cannot tell us from personal experience whether an overcrowded district is productive of the greatest amount of plague?—From my personal experience, taking the localities I practise in, I consider Mandvi an overcrowded place.

18,333. But you have told me that all Bombay is overcrowded; I ask you which is the most overcrowded?—Mandvi, so far as I know. In certain chawls many persons were affected one after the other.

18,334. That, again, bears upon the overcrowding of special houses. Then with regard to the next point, what have you to say with regard to the increase in the sub-soil water?—An increase in the sub-soil water fructifies the germs.

18,335. That is theory, I want facts. Why do you say that? Can you mention a district where the sub-soil water is in a condition which you think is especially favourable for the increase of plague, and can you tell me whether plague is especially prevalent there?—At Mandvi I find the sub-soil increasing, and I find that the level of the water in certain wells had increased in those localities where I practise. If you were to examine the water of certain wells in Bombay you would find nothing but filthy water from the surrounding drains.

18,336. It is not merely the fact that the water is high, but the fact that there is filth in the sub-soil water?—The sub-soil water has a certain effect upon the propagation of plague, that is my argument. Wherever there is an increase in the sub-soil water there plague cases are found in abundance.

18,337. Can you tell me where there is a special increase, and whether plague has increased in that district?—In Mandvi there has been an increase in the sub-soil water, and there cases are still running on, and

have been doing so from the time of their commencement.

18,338. Is Mandvi the only part of Bombay where the sub-soil water has increased?—The sub-soil water has increased in Girgaum and Dhobika Talao.

18,339. Is the plague worse there?—Plague cases are found in abundance there as well.

18,340. They are found, I understand, all over Bombay; but is the total number larger in places where the soil is waterlogged?—Yes, where the soil is waterlogged.

18,341. What have you to say with regard to bad drains?—In most parts of Bombay we find the drains are badly laid, badly cemented, and badly paved, the consequence being that there is oozing from the joint connections. This tends also to increase the sub-soil water. I have noticed that wherever there is a smell from the drains plague cases occur.

18,342. Do you mean to say that in every place where you have smelt bad drains you have found cases of plague?—I have seen plague cases in those very houses.

18,343. Is there any other point bearing upon the diffusion or increase of plague which you would care to bring before us?—These factors, in my opinion, increase the propagation of plague.

18,344. I wish you had been able to give more facts, because we can get opinions to any extent. Have you had any experience of preventive inoculation?—Yes.

18,345. What experience?—I think inoculations immunise persons.

18,346. What is your experience with regard to inoculated persons?—All the persons who have been inoculated are now living, though they are scattered all over Bombay, and living in the worst possible localities.

18,347. They are all living?—Yes, they are all living.

18,348. When did you inoculate these persons?—I inoculated in 1897, 1898, and 1899.

18,349. What record have you kept?—I jot down the names, ages, and addresses according to the form prescribed by Prof. Haffkine. We send a return of these people every week.

18,350. You trace them out weekly?—Yes. We inoculate those persons who come for inoculation.

18,351. After inoculating them what do you do? How do you trace them?—After I have inoculated them I have my eye on these patients. I know them very well; they are not outsiders. I have inoculated about 600 families.

18,352. How often do you see these 1,800 persons?—Every now and then.

18,353. What do you mean by every now and then?—If any person died I should know it at once.

18,354. How?—Because they are within my range. I have to treat them—treat their families, and so on.

18,355. You have no other means of tracing the after history of these persons?—In addition to that I read the daily mortuary returns, and I do not see any of the names of these people in the returns.

18,356. These daily mortuary returns give the names, do they?—Yes.

18,357. Anything more?—Nothing more.

18,358. I should fancy there would be many persons who had not been inoculated by you who had the same name?—I could find out at once from the surname.

18,359. But there must be several surnames the same?—I do not think so.

18,360. In all Bombay?—I do not think so. I have inoculated most of our Parsees.

18,361. That is the only way in which you can identify them. I suppose?—No.

18,362. (*Mr. Cumine.*) Have you measured the height of the sub-soil water in the various quarters of Bombay?—I have not measured it, but I have seen it with my own eyes where the borings were taken by the Municipality.

18,363. Do you know what the *relative* height of the sub-soil water is in different parts of Bombay?—Yes.

18,364. What is the height of the sub-soil water in Girgaum?—About 12 feet.

18,365. What is it in Nagpada?—I cannot say. I am not interested in that locality.

18,366. Then you do not know the relative height of the sub-soil in each quarter of Bombay?—No.

18,367. If you do not know the relative height of the sub-soil water in the different quarters of Bombay, how can you say that there is a connection, a relation, between the height of the sub-soil water in the different places, and the extent of plague in those places?—Where there is an increase I find many more cases cropping up. In certain parts of the town, wherever I have seen the relative height increasing, there I have found many cases. According to your statement I cannot tell you.

18,368. You spoke about leakage from the drains; have you inspected all the drains of Bombay to find out which leaked most?—I cannot say in which locality the drains leak most, but from my own personal observation I can say that in most parts of the town there is a leakage.

18,369. But have you inspected them all to find out which of them leaked most?—I cannot answer that question.

18,370. How many of these 1,800 people have died since you inoculated them?—Not one.

18,371. How long is it since you inoculated them?—I commenced my inoculations in January 1897.

18,372. So that in two years out of 1,800 people no one at all has died?—Not one of them has died.

18,373. You say that these 1,800 people represented 600 families; and that if anybody had died you would have heard of it, because there is always somebody from the 600 families coming to be treated. Do you mean to say that there is always someone ill amongst them?—I generally see them once a fortnight.

18,374. Even if one member came to be treated, the whole family would not come, would they?—I generally inquire how they are after inoculation.

18,375. (*The President.*) Is there much sickness among these 600 families?—In any community where there is a large number of men, every now and then we find certain seasonal diseases cropping up.

18,376. Is there much sickness amongst the 600 families?—Not much, I should say.

18,377. How can you see them frequently if there is not much sickness?—Some come for ordinary treatment.

18,378. Do you mean when they are not ill?—When they are casually ill.

18,379. If they are not ill, and there is very little sickness among these families, they can only come to you very seldom?—At the same time I generally inquire after them.

18,380. Do you go to see them?—No. I inquire after the relatives when they come to see me. I see them once a fortnight.

18,381. What do they come to see you for?—For treatment.

18,382. But you say there is very little sickness?—In cases where I have performed inoculations I inquire of the relatives.

(Witness withdrew.)

Major RICHARD BAKER, I.M.S., called and examined.

18,383. (*The President.*) I believe you are in the Indian Medical Service, and have the degrees of M.A. and M.D.?—Yes.

18,384. You have had experience in Upper Sind and Satara?—Yes.

18,385. In the first place, what have you to tell us with regard to the measures which were adopted?—The measures adopted in Sind were for the early detection of cases, for the isolation of the sick, for the segregation of contacts, and health camps. In addition to that in

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Sukkur we had a fourth camp, which was used as a detention camp. It was an observation camp for people coming in and going out of infected quarters. The measures for the detection of the sick at an early stage were various. Small rewards were offered for information; we made private inquiries, and we had search parties.

18,386. What rewards did you find necessary; what sum did you offer?—Very small sums—eight annas and one rupee. Private inquiries too, were made. A number of reliable officers were always deputed where plague had broken out, and we made as many inquiries as possible ourselves, also through our Government servants and neighbours. In addition to that there were search parties.

18,387. Was it a voluntary or paid organisation?—We had both. Speaking for myself I am inclined to think that the voluntary organisations were more useful in their results than military search parties.

18,388. I believe you employed these measures in a large number of towns and villages?—They were employed in Sukkur. In Shikarpur, which was curiously exempt from plague, I told the people that if they used all possible precautions themselves they would possibly avoid the necessity for sending military search parties. I am inclined to think that that had a very good effect, because the natives did not care for military search parties.

18,389. You were employed in Hyderabad?—For a short time.

18,390. And you were also employed in Daharki, Tatta, Karad, Lanauli, and Igatpuri?—Yes.

18,391. And you adopted the measures which you have described at all these places?—Yes. I may say that my functions were more supervisory and advisory than actually executive, because Mr. Wingate employed me in that capacity very largely. He sent me all about the country. In Tatta I found that this elaborate method of having so many camps was by no means necessary. The great dread was that we should have a camp epidemic in the segregation camp, but according to my experience there never was a camp epidemic in the segregation camp. If a segregation camp is properly organised and looked after, and each inmate inspected every day, and each case as it occurs at once sent to the isolation hospital, and proper methods taken for disinfection, I have never, in my experience, seen any symptoms of even the beginning of a camp epidemic.

18,392. What course did you there adopt?—I combined the segregation, health, and detention camps.

18,393. What did that leave you with?—A hospital for isolation, and one large camp. I found that workable for this reason, that when a disease breaks out in a place there is an exodus from that place, and as the disease abates there is a return of the fugitives. The amount of camp accommodation for both is practically constant, otherwise it would not have been workable. Of course it was much more economical, and much more easily managed than a series of separate camps.

18,394. Did you usually get very early information of the first imported case?—In Hyderabad we did, and in Sukkur at the beginning of the disease we did not: but when the people realised the nature of the disease, many of them came to inform us themselves—even the relatives came to inform us.

18,395. There were some villages in which you got early information of the first importation?—Yes.

18,396. What measures did you adopt in those villages?—The imported case was removed to hospital, and the people in the house were removed to the segregation camp, and the house itself was disinfected.

18,397. What was the result?—Mr. Dodgson, the Collector of Hyderabad, and myself, are distinctly under the impression that our efforts in that direction did stall off the occurrence of local plague in Hyderabad for some time, because there were at least five cases of imported plague spread over a long time before we had a local case, and we can trace the reason why we got that local case.

18,398. In any of these places did you actually prevent plague from becoming local?—Yes, for a time, that is our belief.

18,399. Finally plague became indigenous?—Yes.

18,400. When plague became indigenous what did you do?—When it became indigenous we cleared out larger areas,

18,401. Did you find that effective?—I cannot speak for Hyderabad. I was transferred from Hyderabad. I was doing work as Civil Surgeon of Hyderabad before I took up my special plague duties. Subsequently I was busily engaged in Sukkur.

18,402. Was Hyderabad the only place in which you partially evacuated areas?—I may mention that when I first went to Sukkur I found one imported case, and had it removed. Apparently, however, there was another imported case which I failed to move, and within a week or ten days I was sent to go to Sukkur again. I found that this second case had established a large centre in a temple, and measures had to be taken.

18,403. What was done; was the area evacuated?—This case occurred in a temple, and many other cases occurred there. People have a tendency to go to temples to die. This man went to the temple to die, and he infected the people in the temple. A large number of people were found in the temple dying or dead. The temple was dealt with the aid of a gang of 20 coolies, of whom 5 died of plague in a week, owing to the fact that there was no previous disinfection of the temple.

18,404. Did you evacuate the area?—That area was evacuated, but not properly evacuated.

18,405. Partial evacuation took place?—I would prefer to call it ill-directed evacuation. The result was unsatisfactory.

18,406. Was there entire evacuation afterwards?—Afterwards the disease spread over the place. I can give you a very successful instance of evacuating a large portion of a town. The part of Sukkur known as Gharibabad was infected. There were supposed to be 1,000 people in that part of the town, and in 16 days they died, at the rate of 25 a day, leaving 601 people in the town. During those 16 days, with the aid of the Railway Company, we erected a very complete camp—the most complete I have ever known. On the 17th day the 601 people were moved out.

18,407. With what result?—With the result that the 601 people escaped plague, except one who developed the disease within 24 hours of his removal to camp.

18,408. You did not have another case in the segregation camp?—No.

18,409. What happened in the portion of the town from which they were evacuated?—The people went back gradually.

18,410. Plague stopped there?—There was nobody to get plague. Absolutely every individual was segregated. The whole of this outlying portion of the town, which was quite separate, was evacuated.

18,411. The other parts of the town were not infected?—Not to that extent at all.

18,412. Did you have any case in which you at once evacuated a whole town or village without having first carried out partial evacuation?—No, I do not think so.

18,413. Your experience has been of cases in which there has been partial evacuation, afterwards followed by complete evacuation?—Yes.

18,414. As a rule, you found partial evacuation sufficient?—Yes, temporarily.

18,415. But on recourse to complete evacuation it was successful?—Yes.

18,416. How long did you generally keep people out of a town or village?—In Sukkur the people were kept out of the town longer than would otherwise be necessary, to admit of complete disinfection of their houses.

18,417. How long?—They were kept out of the town for about a month.

18,418. In the meantime the houses were disinfected?—Yes.

18,419. And the people were then allowed to go back?—Yes.

18,420. Was there any recrudescence of plague in the disinfected houses?—No.

18,421. Total evacuation combined with disinfection have been very satisfactory in your experience?—Evidently so.

18,422. In what position do you put these measures in regard to other measures?—In the first position.

18,423. I believe you have had some experience with regard to disinfection alone, apart from anything else?—Yes.

18,424. What are your views as to the value of disinfection?—Perhaps the best way that I can point that out to you is the danger of the want of disinfection, and the value of it in other places. There are cases as to the value of disinfection in Karachi, which came under my notice incidentally, where the plague wards were daily dreached with perchloride of mercury.

18,425. Plague wards?—Wards of the Plague Hospital—the floors.

18,426. But at the hospital there were many other conditions besides; I would rather you would take ordinary habitations, because hospitals are not comparable with ordinary habitations?—It would be easier to give you an example of the failure of disinfection where segregation is incomplete, that is to say, where the unaffected inmates are still left in the houses.

18,427. What is you experience?—At Igatpuri, during the rains, it was extremely difficult to segregate, I was told, because of the want of places in which to put the segregated people. They had no accommodation, and consequently segregation was not attempted, but each case was removed to hospital as it occurred, and each house in which plague occurred was disinfected. The result of that was that other cases which were still in the incubation stage at the period of the isolation of the infected person developed, and fresh cases continued to develop in the houses, each case being followed by the isolation of the patient and the disinfection of the quarters. In one instance what was found to be necessary as often as seven times.

18,428. Your view is that disinfection alone is inefficient?—Certainly.

18,429. Have you any experience of protective inoculation?—I have no statistics to offer. My impression is a general one.

18,430. What is your impression based upon?—Merely upon observation but without figures, because I had nothing to do with inoculation myself. In the course of my inspection work I had occasion to observe what the effects had been in a general way. The most striking was at Lanauli, where the people living on one side of the railway line had been subjected to inoculation, and the people on the other side of the line had not been subjected to inoculation. In the place where inoculation had been made use of the town was thriving and full of people, and the other side of the line was absolutely empty. I came upon this merely by accident.

18,431. One side had a greater amount of plague than the other?—One side had plague and the other had none.

18,432. How much plague was imported on each side of the line?—I made inquiries and was told there was no difference, but I do not know about that.

18,433. Is that your whole knowledge with regard to inoculation?—Yes. I have no special knowledge of it.

18,434. (*Mr. Hewett.*) I understood you to say that you considered that at Hyderabad you practically stopped the possibility of infection by dealing with the imported cases as they occurred?—Yes.

18,435. Dr. Henderson, who was there after you, said that the infection of rats followed the imported cases and occurred before the local cases; have you observed that anywhere?—When it does it occurs almost simultaneously with the occurrence of the first indigenous case.

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18,436. Do you mean that it occurs simultaneously with the first indigenous case that is detected?—Yes. I have never heard of a distinct case of rats having been found dead any length of time before the detection of the indigenous case.

18,437. Do you think it possible that an imported case occurs and infects the place and then the rats become infected, and that simultaneously with the infection of the rats human beings become locally infected?—That is the way in which I think the disease becomes local.

18,438. Whatever you do with the imported case you have always that danger?—Yes.

18,439. Did you have in Sukkur much pneumonic plague, or was it mainly bubonic?—My experience was in walking through the hospitals, which I did every morning, although I was not in charge of them. I do not know the normal proportion, but I should say there was a fairly large number of pneumonic cases.

18,440. Did any example come to your notice of a bubonic case communicating pneumonic plague or *vice versâ*?—No, I have no information upon that point.

18,441. The temperature at Sukkur was extremely high, I think?—Yes.

18,442. Did you notice that the disease gained strength as the temperature rose?—Up to a certain point it did.

18,443. The rise of temperature did not seem to check it?—No.

18,444. What is the population of Sukkur?—There are three towns really—Sukkur, Rohri and New Sukkur, and I should say the total population was about 40,000.

18,445. What number of people had you in the segregation and health camps there?—600 people.

18,446. Only 600?—Only 600 in the only camp worth considering, the others were very small.

18,447. Therefore there was very little evacuation of the town?—The evacuation was of an outlying portion of the town.

18,448. The main portion of the town remained unevacuated?—Yes.

18,449. When a plague case occurred in the main portion of the town, what measures did you take?—Isolating the case and segregating the people, but the numbers in the town itself were very small compared with the numbers at Gharibabad.

18,450. You left the neighbours alone?—No, we put the neighbours into a segregation camp, but the numbers there were very small compared with the numbers at Gharibabad, so that that would hardly affect the question.

18,451. (*Mr. Cumine.*) Did you disinfect the clothing and effects of those 601 Gharibabad people when you took them out into the health camp?—Yes.

18,452. Do you think that is necessary to make the plague stop on evacuation?—Yes, I think it is safer at any rate.

18,453. With regard to Lanauli, does the railway line divide it equally into two parts?—Fairly equally, probably the greater portion were on the healthy side.

18,454. Is there any difference between the classes of people who live on the two sides?—No.

(Witness withdrew.)

Mr. G. W. ROUGHTON called and examined.

Mr. G. W. Roughton.

18,455. (*The President.*) What district are you prepared to speak about?—Kolaba and Fort Northern.

18,456. (*Mr. Cumine.*) You began plague work, I think, on the 31st December 1896?—So far as the Volunteer Artillery was concerned, I did.

18,457. With whom did you begin the work?—With the members of my corps, the Bombay Volunteer Artillery; but that was nothing to do with the house-to-house inspection, which was also worked. That was when we started doing actual plague work at the request of Dr. Weir. That was on the 31st December 1896.

18,458. What did you begin to do in March 1897?—I was appointed President of the Justices, who had been asked by Lord Sandhurst to look after the work, and I had the whole of the district from the Victoria Terminus to Kolaba under my control.

18,459. That would include the two parts called Fort and Kolaba?—Yes.

18,460. Did you retain the whole district throughout?—No; as a matter of fact during the first three or four weeks the work was confined, as far as I had anything to do with it—Mr. Raikes being my assistant—to work at Kolaba. Fort Northern was then a separate district. Although I was appointed plague authority for both districts, really we confined our attention to Kolaba.

18,461. The Upper or the Lower?—Both. From Sassoon Dock to Kolaba was not much trouble.

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18,462. When you began this house-to-house visitation in March 1897 who formed the search parties?—They were entirely members of the corps with the addition of Mr. Raikes and Mr. Howard, Mr. MacDonald (not Mr. James McDonald), and one or two officers of the Preventive Department.

18,463. The plan adopted, I think, was to meet every day at a given rendezvous, and decide what houses were to be searched?—That is so. I have here a map* of the Kolaba district, and I have marked on it with a red cross every house which is the centre of infection.

18,464. Was it possible for cases to escape detection or were the search parties too numerous for that?—At first it was possible, but eventually it was absolutely impossible. Then there was another thing; as it was seen that the whole agency was European, it was impossible for cases to be imported. That is what we had to struggle with at first. The result was that in something less than a month we had driven the whole of the plague out of our district. Of course it went to others, but that we cannot help.

18,465. In the first epidemic from March to June 1897, I believe some resistance was encountered?—Yes, a great deal; but in the second, from November 1897 to March 1898, there was no resistance encountered at all, except in Hamal Lane where there were five Muhammadan houses. That was the only place.

18,466. Did you find the inhabitants willingly present themselves for examination?—Yes. I never made so many friends in my life. You must remember that there is a great deal of zulm (oppression) in this sort of thing, but the remark which was commonly made to us was "Come every day, and then there will be no zulm." They were quite pleased to see us. We got to know pretty well everybody in the district, and everybody in the district was seen once at least in three days. I had such a large staff that, the place being not very large, there was not enough work for us. After the first three weeks we knocked off into double parties. You have to bear this in mind, that the Europeans working there knew the language, more or less, and could explain the matter to the people, and they did not attempt to interfere in any way with their caste prejudices. We knew what they were, and at the same time while enforcing the law we did what to our minds was right.

18,467. I think some houses were visited every day, and some not more than twice a week?—That is so.

18,468. Which were the ones visited every day?—Those in Hamal Street and Borah Lane.

18,469. At first were the houses in which plague cases had occurred vacated?—No, not in the first epidemic.

18,470. Later when the second epidemic occurred were they all evacuated?—Every one, if a second case occurred therein.

18,471. Had plague at that time become virulent?—There was a most extraordinary difference in the two epidemics. During the house-to-house visitation in the first epidemic you could tell by a man's eyes whether he had the plague or not. In the second epidemic there was often nothing of the sort; there were none of the usual symptoms. There was no furred tongue, and no *facies pestica* in a man's appearance, no swellings in the groin or neck or anything. That was a thing which struck me very much. In the first epidemic I could identify plague at once, although, of course, I am only an amateur.

18,472. Did you find that more people died in the second epidemic or less?—I have not considered that question, but I am quite certain of this, that the third epidemic is much more virulent than the other two. I hope to resume my work again to-morrow.

18,473. Did you find that cases occurred in fresh houses in the second epidemic, or in the houses in which it had occurred the year before?—It was practically entirely confined to those in which the epidemic had occurred the year before; they occurred even in the same rooms. After that the rooms were absolutely stopped from further occupation.

18,474. For how long?—For one month. They were the orders we got from the District Medical Officer.

18,475. Did you find when they were re-occupied after a month that cases occurred in them again?—In one instance only.

18,476. When did the first epidemic end in Lower Kolaba?—Practically a month after we started. We started, I think, in March, and it ended about a month after. We had the whole thing under control then, and there were none but sporadic cases.

18,477. When did the second epidemic begin?—In the following November.

18,478. Was the same system adopted?—No, because we had not the same staff. We did not have the European troops, and we did not have the Native soldiers to assist us, but so far as we could we adopted the same system. I have brought for the inspection of the Commission a photograph of the Staff on the first occasion (handed to President). We had 13 soldiers and a certain number of Native soldiers and some Policemen in the first epidemic; in the second epidemic we did not have them.

18,479. What did you have in the second epidemic?—Nothing but a few Policemen. The rest of the work we did ourselves.

18,480. When did you get Lower Kolaba practically free of plague in the second epidemic?—About a month after we started work. Then I wrote to the Chairman (Sir James Campbell) stating that it was useless to waste our time in Lower Kolaba, because there was nothing to do. I said that he had better transfer the rest of us to Fort Northern where we could do work, and leave four men at Kolaba, which was done. They were quite sufficient; we were so much in touch with the whole district that every man who was engaged on the work knew every house.

18,481. What results have you observed as to the effect of light and air on the disease?—My belief is that it does not matter a bit whether you have light, or whether you have air. I have formed that opinion on three particular houses which were all upper-storeyed houses, in which not a single case occurred on the first, second, or third floor, but in which several people died on the top floor. Of course, the tiles had not been removed, but that is the fact. I have said in my précis of evidence that I cannot understand how otherwise the disease can be anything but air-borne, unless, of course, the unfortunate persons went outside and contracted the disease, and then came back to their homes to go through with it. But that is incompatible with one particular case. There were three barbers living in the same house, one working in the Fort, one at Kolaba and one in Fort Northern. Those three men were perfectly well one night and were dead the next morning.

18,482. Do you know whether it was pneumonic plague or not?—No, that I canot tell you, but Dr. Barry can, because he was there.

18,483. Do you know whether the other inhabitants of the house were in the habit of going to the bazars to earn their living?—Undoubtedly; they were all Ghatis (mill-hands). They all worked in the local mills at Kolaba.

18,484. Was there any plague in the local mills at Kolaba?—Yes; I took two cases out.

18,485. Was there much plague there?—No, I do not think so.

18,486. May it have been that those mill-workers were exposed to less infection than the three barbers; that the barbers may have gone into more highly infected bazars?—One of the barbers shaved nobody but the officers of the Royal Artillery at Kolaba.

18,487. After having had experience of two epidemics what is your general conclusion as to the way in which plague can be overcome?—My opinion is that it cannot be overcome except by the strictest supervision by Europeans—Europeans who know the natives and know their habits and customs. Secondly, if segregation is not to take place, the people must be segregated in their own houses and not allowed to go out, so as to let the plague die out in each house. That is my opinion. I should adopt exactly the same system as they adopted in London during the great plague epidemic in 1666 as related by De Foe. I would lock the house up and not let a single person come out; but I would give them the option of going to a segregation camp if they chose. If you do that you have a chance of stamping the plague out, but not otherwise. It must be remembered that all the people are fatalists.

* Not published with the Proceedings of the Commission.

18,488. If plague is carried by rats how would locking the people up in a house prevent it spreading to another house?—It would die out in time, but of course not so quickly. It must be remembered that these people are not afraid of death in any way, so far as I can make out. What they want is not to be interfered with, and, if they have got to die, to be let die. That is the only way to prevent plague spreading. I have had 20 years' experience of natives in this country, and know something about what their prejudices are.

18,489. (*The President.*) Have you anything else you would like to add?—My evidence has related hitherto entirely to Kolaba. I should like to say with regard to Fort Northern that it is a very much more difficult district to work. In the first place it is not, like Kolaba, a district where you could cordon a certain section and deal with in that way. The inhabitants are of a very different character. Therefore it was not possible to adopt the same stringent measures in Fort Northern as we did in Kolaba. We did not succeed in quelling the epidemic there in anything like the same time we did in Kolaba, but we did it eventually. I submit that if you are going to endeavour to work on the present lines at all you must have a very strong hand, a hand not afraid to carry out measures but at the same time one which is not prepared to quarrel with the people.

Mr G. W. Roughton.

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(Witness withdrew.)

Mr. A. BRITTO, called and examined.

Mr. A. Britto.

18,490. (*The President.*) What are your medical qualifications?—I am Licentiate of Medicine and Surgery of the Bombay University, and Deputy Health Officer C ward, Bombay Municipality.

18,491. I believe you have been engaged in plague operations?—Yes. At present I am in C ward, but at the commencement of 1896 I was appointed to Mazagaon and Tarwadi.

18,492. Have you any information as to the origin of plague in Bombay?—With regard to the first epidemic there is very little information of a definite character, but there is very little doubt that the disease has been imported into Bombay from outside, because prior to the outbreak there was an epidemic at Hong Kong and in Asia Minor. The conditions existing in Bombay are favourable for subsequent outbreaks once the disease has been introduced.

18,493. Do you mean the plague has never disappeared?—Yes.

18,494. There have been recrudescences?—Yes.

18,495. What knowledge have you as to the contagiousness of plague?—Plague is contagious as well as infectious.

18,496. How do you distinguish between the words contagious and infectious?—By contagious I mean by touch, and infectious by introduction into the blood actually by injection.

18,497. What do you say with regard to contagion?—In contagion by human agency, a plague-stricken person acts as a sort of centre of infection by infecting the room or rooms in which he may be moved, and then there is the careless disposal of excretions, chiefly the vomits and the dejecta, all of which contain plague bacilli.

18,498. Do you know if the vomited matter contains plague bacilli?—Yes.

18,499. What is your knowledge about that?—I have not made a bacteriological examination.

18,500. Now, with regard to clothes. What is your knowledge with regard to their being infectious or contagious?—I go on house-to-house visitation, and very often clothes worn by individuals suffering from plague are kept away from us, and these clothes are subsequently used by healthy persons. I really believe the infection is taken by wearing these clothes.

18,501. Do you know any case in which clothes have conveyed infection?—I cannot give you a case, but I can give you a case in which the bedding used by the patient has caused it.

18,502. You withdraw the statement regarding clothes?—Yes. With regard to bedding there was a case at Mazagaon in which the bedding which had been used by the patient was kept by the people; they were not given to us to be destroyed. That bedding was afterwards used, and we had other members of the family who got plague.

18,503. Are you aware whether the other members of the family came in contact with the original patient?—Yes, they did, except the younger members.

18,504. How can you exclude infection by other means? Why do you restrict it to the bedding? Have you any other instance?—No.

18,505. What are you prepared to say with regard to infection?—Infection is taken by wounds and abrasions in the surface of the body and the mucous membrane.

18,506. What is your knowledge about infection through wounds and abrasions in the skin; have you seen cases?—Yes. There have been cases in which people have had slight eruptions. It is not uncommon to see people in Bombay with scabs. Then, also, the natives of Bombay have a kind of eruption which is more of an eczematous character, generally about the loins. I have met with cases of plague in which these conditions existed, that is, the conditions of eczema and scabs, and I have no doubt the infection has been through these.

18,507. Have you had any experience of infection by food?—No.

18,508. Do you know of any case of plague in which the infection was introduced by the digestive system?—I do not know of any direct case.

18,509. What is your knowledge with regard to infection by the respiratory system?—There was a case of pneumonic plague which occurred in a house in the month of August, in the section in which I work. There was one pneumonic case which was concealed from us. Subsequently I found two cases in the same house, one was the manager of the firm, and the other was a woman who was also connected with the firm. Both she and the manager got pneumonic plague. I examined them both at the very commencement, and pronounced the cases to be pneumonic plague. Both of them died. In the case of the manager, one of the attendants subsequently developed plague and died in another house.

18,510. You observed one case of pneumonic plague from which two cases directly proceeded, and then a third indirectly?—Yes.

18,511. How do you know that in any of these cases the plague was introduced by the respiratory passages?—From my observation. The man was lying on a bed on the floor, and was being held by the attendant. The attendant had a little chatty which contained the plague sputum. They generally have a small copper vessel into which the man spits, and this is generally held up to the man's mouth by the attendant. Besides being in such close attendance, it is natural he may have inspired the same air.

18,512. The attendant took plague?—Yes, and he died.

18,513. Might he not have soiled his hands?—Yes; he was holding the patient besides.

18,514. Might not the sputum have been introduced into his own mouth and face by coughing?—Yes, but that would be direct.

18,515. That need not be by the respiratory passages; it might be by the alimentary canal?—If it went to the alimentary canal the form would be enteric.

18,516. Not necessarily. You have had some experience of preventive inoculation, I think?—Yes. When I was in charge of Mazagaon, I made a number of inoculations in company with Major Bannerman, I.M.S., in the most infected centres. This was in March 1897. During the next recrudescence in November up to the end—that is March—I did not observe any cases of plague amongst those who were inoculated.

18,517. How many did you inoculate?—There were about 200 inoculated.

18,518. What record did you keep of those inoculations?—They were in the same locality, and I had occasion to visit them every day in house-to-house visitation.

18,519. For what period did you keep them under observation?—During the time the epidemic raged, which was five months.

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18,520. Did none of those people leave the place during those five months?—No; they are low-class people, and could not afford to leave unless we took them ourselves into camp.

18,521. Did any of them die in that time?—Not to my knowledge, not those who were inoculated, because we directed special attention in cases of plague to observe whether an individual who got plague had been inoculated, and by whom.

18,522. Have you any other 200 people in similar conditions of life and locality who were not inoculated to compare with them?—The contrast was obvious from the fact that we did not get any cases among the inoculated, whereas we did get plague among others living in the same houses.

18,523. Will you give us some examples of that?—There is a place in Mazagaon, known as Telang's property, in which the chawls are very large. In one of the houses there we did as many as 26 inoculations. We had a number of plague cases there, but we did not have one among those persons who were inoculated. There is plague there even now. Another instance is a place known as Bawan's chawl. I do not know the exact number we inoculated, but we did not observe any cases among those, whereas we got plague among the other residents of the place, so much so that the place had to be evacuated, and the people removed to a health camp.

18,524. Are these inoculated people kept under observation now?—I do not know; I am not in charge of the district now. I have been away since June, and am now in charge of C ward.

18,525. You do not know whether they have had plague since?—No.

18,526. Did you make any selection of the persons inoculated?—No, unfortunately we have no choice in Bombay, because the people are very loth to be inoculated.

18,527. You take all you can induce to be inoculated?—Yes. We try and induce them to be inoculated, and then if they consent we inoculate them.

18,528. Even very young persons?—Not very young persons. I have not inoculated babies of one or two years.

18,529. What is the youngest?—Five years.

18,530. If you saw a person obviously unwell, would you inoculate that person?—No, and I would not inoculate contacts.

18,531. Have you given much attention to the clinical study of plague?—Yes, I was in charge of two hospitals in Bombay.

18,532. The symptoms have been fully described in your précis of evidence: have you encountered any symptoms different from the ordinary classic symptoms of plague?—No.

18,533. What do you mean by the cerebral variety?—That variety in which the head symptoms, that is, delirium and coma, are most marked, and where the temperature is not reduced by any treatment—where the temperature rises and the patient dies.

18,534. They are always fatal?—Yes.

18,535. Have they buboes?—No. These cases are rare. I have not noticed any with buboes.

18,536. How do you diagnose the cerebral variety?—First by the facial expression. There is a stolid anxious expression of the face, knitting of the brow, and drowsiness, and then the peculiar condition of the tongue, and the delirium which follows. The cases are rapid, and terminate in death.

18,537. Supposing you had all these symptoms and death did not occur, would you come to the conclusion that they were not cases of plague?—I have not come across any such case, but I should take into account the rapidity with which the symptoms came on.

18,538. What do you mean by the enteric form?—That is where the symptoms simulate enteric fever, but in which the symptoms are more rapid.

18,539. What symptoms of enteric fever are similar?—The first is diarrhœa with the characteristic stool.

18,540. Enteric stool?—Yes.

18,541. Pea-soupy?—Not exactly—yellowish.

18,542. A biliary stool?—Yes.

18,543. Not therefore characteristically enteric?—Not entirely pea-soupy. We do not get any cases of real enteric among the Indians. Then there is great tenderness in the right iliac, tympanitis, and delirium, which goes on from the second to the fourth day.

18,544. What is the form of the temperature curve? Does it resemble the ordinary temperature curve of enteric fever?—I have not noticed the chart very carefully.

18,545. Are there spots?—No.

18,546. What is there in addition which brings them into the category of plague cases?—In some of these enteric cases the mesenteric glands are enlarged.

18,547. Is this observed before or after death?—Previous to death. There is excessive tenderness in the right side.

18,548. The abdomen is generally tympanitic?—Yes but not at the commencement. At the commencement there is gurgling and pain, but not intense tenderness. There is a feeling, though not in all cases, of swollen glands.

18,549. In what region of the abdomen do you feel swelling of the glands?—In the right iliac.

18,550. Then you have specified the hæmaturic variety?—Yes; I only saw one case of that. The man passed bloody urine. Then he got a fit which I put down to uræmic symptoms.

18,551. Was this blood in the urine due to hæmaturia or hæmaglobinuria?—I did not examine by the microscope.

18,552. Have you ever found albumen in the urine of plague cases?—Yes.

18,553. Very often?—In most of the cases.

18,554. Have you seen tube casts?—I have made no microscopical examination.

18,555. Have you made any *post-mortem* examinations?—No, but I have seen the appearances.

18,556. What are the characteristic appearances?—That refers to the position in which the patient lies. We are often called out to see a man who is found dead in the street, and then we have to give our opinion as to whether it was a plague case or not. In the absence of glandular enlargement we look to the position of the corpse; the thumb is generally flexed into the palm, the eye-lids are half open, and the cornea is glistening. Then there is the appearance of the face. There is generally a livid, bluish appearance of the whole body. That is how we come to the conclusion that it is a case of plague in the absence of enlarged glands.

18,557. Putting aside the hæmaturic case, have you seen any œdema of the surface in other cases, either after death or immediately before death?—No.

18,558. If there had been œdema it would not have escaped your notice?—It would not have escaped my observation.

(Witness withdrew.)

(Adjourned till Friday next.)

At The Secretariat, Bombay.

FORTY-NINTH DAY.

Friday, 17th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Prof. A. M. WRIGHT, M.D.
MR. A. CUMINE.
DR. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

MR. REGINALD GILBERT called and examined.

Mr. R. Gilbert.

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18,559. (*The President.*) You are a solicitor of the High Court of Bombay?—I am.

18,560. Where do you reside?—I reside in Bandra, a suburb of Bombay.

18,561. What is the population of that suburb?—About 20,000.

18,562. What is the nationality of the inhabitants?—About half are native Roman Catholic Christians.

18,563. When did plague occur in Bandra?—At the end of 1896.

18,564. When did your experience of the plague there commence?—My actual work did not commence till the 12th of February 1897.

18,565. What was the condition of matters with regard to plague generally when you commenced work?—I returned from Australia on that date, and the epidemic was very bad. Many members of the Municipality had left Bandra, and the Municipality was in a state of chaos, and almost bankrupt. I made the following offer to Government, namely, that I should have entire and sole charge of plague operations in Bandra, Government placing in my hands all moneys required, Government to appoint me President of the Bandra Municipality, I not being accountable or responsible to that body for my plague work, but responsible and accountable to Government only. This was accepted. When I commenced work a large number of people had voluntarily left their houses, and were residing in huts in the fields. I at once turned all the people out of their houses and got them to live in huts.

18,566. The whole of the inhabitants of Bandra do you mean?—Nearly all; the better classes did not turn out. Those that lived in detached houses, for instance, all remained in.

18,567. About how many of the inhabitants were included in this evacuation?—About three-quarters of the inhabitants were hutted: certainly more than half.

18,568. About 10,000?—Yes.

18,569. Had you much difficulty in effecting this removal?—Yes. The following extract from a letter which I wrote to the Collector of Thana on the 8th April 1897, illustrates some of the difficulties I had: "I beg "to say that there have been a large number of cases "of plague here amongst persons who have been living "in huts and segregation camps for ten days and "upwards. I believe I have personally taken or "assisted in taking approximately 70 cases of plague "from huts in which the residents have been living "for at least ten days away from their villages. I "think I can at least place the number at 80, and the "only reason why I do not give more is that a large "number of Danda villagers left their camp and went "back to the village, thus getting infected again, and I "cannot safely trust my memory as to what number "of these were taken to hospital. A large number of "native Christians went into huts. These seldom "returned to the villages, and I found cases amongst "such native Christians who have been encamped for "more than a month. One case of a Christian I "especially investigated, as he was taken with plague "at least 14 days after removing into a segregation hut. "The only way he could have got the contagion was "when he went into Danda with his bullock cart and "removed furniture from the houses of infected people. "I should mention that in many of the above 80 cases "the camps were very dirty, and the faeces of those "encamped there were often quite close to the huts. "On one or two occasions I found persons affected "with plague engaged in making chappattis for the "family so as to distract my attention. So often has "this trick been practised on me that I make a "habit of examining very carefully persons engaged "in cooking when I am doing inspection work. I was "not aware that anyone dare allege now that the "disease is not communicable by contagion. I am not "a medical man, and only give my views with great "deference. I have formed a strong opinion upon the "matter, and that is the disease is very contagious at "first, and less so afterwards; that people who live "in upper storeys escape it most; that it is most con-"tagious in houses which are free of ventilation. I "also believe that those who sleep in very open places "will never catch it." I had great difficulty in getting the people of Danda, a village of about 3,000 fishing people, to turn out. They suffered very badly from plague. They abandoned their dead, and would not assist in their cremation. They also left children with their plague-stricken or dead parents. I had a hospital shed built and properly equipped with a proper staff. Most of the native Christians voluntarily came to hospital at first, but afterwards they concealed their cases. This was, I believe, because so few lived. A few Hindus came voluntarily and one or two Muhammadans. The rest we had to take by force.

18,570. What do you mean by taking them by force?—Actually taking them by force.

18,571. By what instrumentality?—I had to do it myself once or twice, and I had orderlies and police.

18,572. Police and soldiers?—Yes, I had two or three native soldiers with me, and also the Municipal Inspectors and so on.

18,573. What was their opposition due to?—They would not come, so we had to take them on charpoys, or something.

18,574. On what grounds did they oppose the removal?—They thought they were going to be poisoned, and they objected altogether to going to hospital. They believed we intended to poison them, and in many instances they would take no food or drink, or any medicine whatsoever. We had one case of a little Hindu boy who lived for many days, and I believe would have recovered if his parents would have allowed us to give the child food, stimulants, and medicine. They would not yield to all the persuasion we showered on them. Bandra is surrounded by fields, and it is easy to find places for the people to camp out. By the end of April 1897 plague was virtually stamped out of Bandra. I reckon nearly 1,000 people died from it.

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18,575. How long did you take to effect this evacuation?—A great deal had been done voluntarily between Christmas and the 12th of February, when I took charge. Directly I took charge I would not allow anybody to stay in. They all went out—virtually all of those that lived in huts or houses that were crowded.

18,576. How long did it take?—Some were out before the 12th of February, when I took charge. It was then about its highest point. I might mention the following facts. A native family was camped in the fields in hut A for upwards of five weeks free of plague. A case of plague occurred on the 31st March, which they concealed and placed in a small hut B, 50 yards off A. This case died 31st March 1897. Huts A and B were burnt, and the family moved to hut C. On 4th April another case occurred in hut C, and the family erected a fresh hut D, to which they moved. On 9th April another case occurred in hut D, and the family moved to hut E. No further cases occurred. Everybody was out by the middle or end of February, and then by the end of April plague had disappeared from Bandra.

18,577. Can you tell us how many cases of plague had occurred before the end of February?—It would be difficult to say with accuracy, because there was no record kept. Most of the people had absconded. The Municipal staff had run away, and there are no proper statistics which we can go on. I could find out by writing to the Municipal authorities at Bandra, and ascertain how many died previous to the 12th of February.

18,578. Will you do so?—Yes. (Note by witness on correcting the proof of his evidence:—I am sorry to say I have not been able to secure this, and figures are not reliable made at this time, as most of the staff had run away.)

18,579. After the evacuation had been effected how many died?—Quite half, certainly.

18,580. Half the total?—Yes, quite half. I am speaking from memory, but I believe there were more than that, because plague had not got to its height when I took over charge; it was worse for a little time.

18,581. At what time after the evacuation had been effected?—It gradually began to cease when I got them into huts. Of cause cases often occurred in the huts, and so I pulled down those huts, and made them go out and build other huts somewhere else, and the plague gradually lessened.

18,582. Did the number of cases commence to fall rapidly after evacuation had been effected?—Yes, soon after the evacuation. Of course I used to take it village by village. One or two villages did not get plague at once, so I did not move the people out where there was no plague. There are small hamlets at Bandra—small collections of huts, and I never disturbed people unless plague broke out in them. I can give you one notable instance. I found about 200 Mahars living in huts, and on the first day, the 12th of February, plague broke out, and I found a corpse there, and one other person with plague. I had them all out, and hutted, that afternoon. I gave them some material which was handy to build huts, and they were all out by the afternoon. They were absolutely free from plague for the rest of the time. I camped them close to the sea shore.

18,583. That was a very rapidly effected and successful evacuation?—Yes. I have also other cases.

18,584. But the evacuation was not so complete as in this case?—No, not so complete as this one, but I think this was because they were under better control than the others.

18,585. What is your opinion about the value of evacuation and segregation from the experience you have had?—I think it is very successful in small places, but it would be absolutely useless in Bombay.

18,586. What is the maximum population which you think can be moved out?—If you have a town with open country all round, where you can make the people go out, I should not like to say what the limit might be.

18,587. It might be a very large number?—Yes, but in Bombay which is surrounded by sea on all except one side, there is no place to do it, and it would be absolutely foolish to try it, in my opinion.

18,588. You had a good deal of experience in regard to inoculation, I think?—I fought the question very strongly here. I am very much in favour of it.

18,589. Can you tell us what your actual experience of inoculation has been?—I have no actual experience, except more than an intelligent man who reads statistics.

18,590. You had no direct experience?—I was inoculated myself, but it was not done largely in Bandra.

18,591. Your opinion is founded on what you have read?—Yes, and what I have seen of it here.

18,592. And did that lead you to form the opinion that it was a valuable measure for restricting plague?—Yes, I consider it a most important thing.

18,593. Have you got any example which came under your personal observation, in which you found it was very beneficial?—No, none at all.

18,594. Have you found any difficulty in inducing people to be inoculated, or have you had an opportunity of observing whether there was a difficulty or not?—I have not tried it, and I have had no experience. In the little experience I had the people were against it.

18,595. As much against it as against evacuation?—Yes, quite as much, but it was never worked properly.

18,596. (*Dr. Ruffer.*) When you were in charge of the plague operations in Bandra did you have a medical man to advise you, or were you in sole charge?—I was in sole charge, but there were several medical men who assisted me as volunteers.

18,597. Native medical men?—Two natives and a European; they were all volunteers.

18,598. What provision had you for disinfection at Bandra?—I went in for it rather largely. I had a staff of seven men in the Royal Artillery, and I had some native inspectors, and I thoroughly disinfected most of the houses; for instance, at Danda I did every single house. The disinfectant I used was perchloride of mercury.

18,599. In what strength?—I forget now, but it is the same strength as was used in the Hong Kong epidemic. A plague doctor from Hong Kong advised me as to the strength.

18,600. Did you disinfect the clothing of people before they were moved into camp?—No, I did not.

18,601. When you had a plague case in camp did you disinfect the clothing of the people?—No, we had not time.

18,602. What was the staff in your hospital?—I had two European nuns, and two or three native Christians who came from the Bandra Convent, also several native hospital boys, a Hospital Assistant, a compounder, and sweepers. It was very well equipped.

18,603. What was the maximum number of patients you had?—We had altogether in hospital about 150.

18,604. The other cases died in their houses?—Yes, we often found them dead.

18,605. You say in your précis of evidence, "I reckon "nearly 1,000 people died from plague at Bandra"; how did you ascertain that number?—I can give you the official numbers, but they are incorrect.

18,606. Why are they incorrect?—They are incorrect in this way, because I used to take the normal. The normal death-rate in Bandra is one or two a day, and all over that I consider were plague. As a matter of fact, there were officially 800 returned as having died of plague, and I found that that was not correct.

18,607. You also say, "I think in small towns plague "can be stamped out by segregation and evacuation"?—Yes.

18,608. On what evidence do you base that statement?—On practical experience of my own.

18,609. Can you give us an example of that from your own personal observation?—For instance, plague left these people so soon after I turned them out.

18,610. How long after you turned them out?—It began to decrease gradually, and then it disappeared.

18,611. How long did it take to disappear?—It had all disappeared by the end of April. Of course it is difficult to say, as there were two or three hundred huts, and cases kept occurring in the camps.

18,612. It may have gone on much longer than you think?—When they were turned out it left them, it got gradually less, and by the end of April it virtually disappeared. There were only a few cases after the

end of April, but I do not say they were all in the camps, because at the beginning of May I let the people go back.

18,613. And did the epidemic grow?—No, then cholera came.

18,614. Can you give me some information about quarantine regulations at Bandra?—People were not allowed to come in except with passes, and then when they got out at Bandra they were stopped on the causeway and they were examined at the railway station.

18,615. How did you prevent people coming in without passes?—That was done by the Plague Committee.

18,616. You have no information about that?—No.

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18,617. Do you think people got in?—Oh yes, it was a mere question of getting a pass, and they were allowed to go in. People passing over the causeway were examined by a doctor, and were allowed to pass in.

18,618. Do you think the people passed in unknown to the authorities?—I have no doubt they did.

18,619. And you think people got out?—Yes, I am sure.

18,620. How many people did you inoculate at Bandra?—I believe there were only about a couple of hundred done.

18,621. Do you know how many died?—I do not think any died.

(Witness withdrew.)

Prof. T. K. GAJJAR called and examined.

Prof. T. K. Gajjar.

18,622. (*The President.*) You are a Professor of Chemistry?—Yes—Professor of Chemistry at the Wilson College.

18,623. (*Prof. Wright.*) You have formed some views, have not you, about the causation of plague?—Yes, I have.

18,624. Would you explain your views to us?—In the first paragraph of my précis of evidence I say that the origin is due to a combination of two causes—the presence in the air of germs, and the presence of environment. When these two are combined, plague breaks out. I have got several statements giving authorities.

18,625. Do you think these germs are of a specific nature; do you think that a particular kind of germ is necessary?—They must be of a particular genus of cocco-bacilli.

18,626. What sort of cocco-bacilli must be present?—Of a certain morphological shape.

18,627. You think they must be short rods?—Yes, in a way.

18,628. Do you think any short rod-shaped bacillus will develop into a plague germ?—I am not sure of that, but it must be of a particular form as well. The germs are generally styled species; but in the same species you might have pathogenic germs and non-pathogenic germs, or saprophytic and parasitic.

18,629. In the classification of bacteria which is generally adopted, do you not think that the physiological properties are taken into consideration as well as the morphological shape?—Yes.

18,630. You do not differ from ordinary bacteriologists in this matter. You think with them that the plague germs are bacilli which have a particular shape, and which are endowed with certain special physiological properties?—No, I do not think so. They are not endowed with specific and constant characters. If we accept the general view of the "species" of germs, even then there is a variation in the same "species." When we say there is a "species" of germs which we call plague germs, in that "species" will lie, as well, germs of a non-pathogenic nature and germs of different degrees of pathogenic virulence.

18,631. What are the circumstances that you think gave virulence to the bacteria?—The environment—the media.

18,632. You think, then, that, in addition to the germs, some other influence must be at work to produce plague. What environment do you think is necessary; do you not think that a plague germ of sufficient virulence will infect an animal in any part of the world?—Yes, that is what I think.

18,633. You mean, when you have a weak and attenuated germ,, some further circumstances are required to cause the development of plague?—Yes.

18,634. What kind of environment do you think is required?—Some filth.

18,635. You think, under filthy circumstances, the bacteria acquire more virulence?—Yes.

18,636. Do you think that they require certain other conditions?—Yes.

18,637. You have, in your précis, laid some stress on temperature and moisture of the air?—Yes.

18,638. Do you think that plague bacilli flourish most luxuriantly when the air is moist?—Yes.

18,639. Can you account for the fact that plague bacilli do not flourish in Calcutta, where there is both moisture and filth, while they flourish in Bombay?—The sewage decomposition may not have reached the particular stage we have it in Bombay.

18,640. I understand that Calcutta is extremely filthy, and that the smells are extremely bad, and that in that respect Calcutta is worse than Bombay. Have you any theory to account for the fact that plague is very active in Bombay and very quiescent in Calcutta?—Either germs of a sufficiently virulent degree may not be present in Calcutta, or the particular stage of decomposition may not have been reached, although it may appear very filthy and very foul. Further, we do not know what particular products and gases of decomposition are necessary for this purpose. Unless we analyse the air comparatively, we cannot determine that.

18,641. Then a combination of sewage decomposition and of germs is not by itself sufficient to cause an epidemic. Is that your opinion?—Sewage decomposition of a particular kind at a particular stage can develop plague in combination with germs in a particular stage of evolution.

18,642. Are you able to be more precise about this; can you say what particular kind of sewage decomposition is required for the development of plague? For instance, can you explain how it is that the sweepers who carry away the ordure of Bombay suffer very little from plague, although they come in contact with every kind of sewage?—Decomposition of long-standing sewage matter on a sufficiently large scale, leading to the evolution of such poisonous gases as carbonic acid, sulphuretted hydrogen, ammonium sulphide, and different toxic amines in a concentrated form would be necessary for developing plague. The sweepers acquire immunity from being accustomed to work in filthy surroundings; their immunity is due to that fact.

18,643. In view of the great sewage pollution which exists in Bombay, do not you think that everybody in Bombay must have acquired such immunity?—I do not think all people live in such surroundings.

18,644. But all the people who live in filthy surroundings would have acquired this immunity, would they not?—Their occupations are not such, and the surroundings in which they live are not habitually such as the sweepers are brought to in their work. They were not exposed to such filthy conditions before the evils of the sewage system were developed, I am glad to say.

18,645. You say that sewer gases probably exert an influence on the development of plague. One of the arguments you adduce for that is that more "attacks of plague" occur at night?—Yes.

18,646. What do you mean by "attacks of plague;" do you mean people begin to sicken of plague during the night?—Yes.

18,647. Have you any statistics to show that people come into the hospitals more at night than in the daytime?—They are not generally sent to the hospitals at night; they are sent during the daytime.

18,648. What evidence can you adduce of the fact that people begin to sicken of plague during the night, and not during the day?—In the localities with which I am acquainted I heard of more attacks at night; and if you require a statement, I will furnish a comparative

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statement, where information of night-attacks was obtained, and information of attacks during the day.

18,649. Have you evidence on that point, sufficient to satisfy you that more people begin to sicken of plague at night than in the daytime?—Yes, I am satisfied. Further, I have got several statements ready in support of the view I put forward. It is not an original theory; it is the pithogenic theory of Murchison. I am not here to suggest any new theory, such as the millet theory of Dr. Waters.

18,650. You have expressed yourself dissatisfied with the antiseptics at present in use—mercuric chloride, for instance. Do you doubt that mercuric chloride will kill germs?—Yes, I doubt that.

18,651. Have you made experiments on that point?—I have not actually experimented with plague bacteria.

18,652. Have you made experiments with other bacteria?—Yes.

18,653. Have you found that bacteria can grow in mercuric chloride solution?—No, because they are rendered inert, inasmuch as an insoluble casing is formed by coagulated albumen.

18,654. What is the albumen which becomes coagulated?—If the germs are in an albuminous medium, the albumen will be coagulated by the action of mercuric chloride, and this coagulated albumen will protect them.

18,655. Eggs, I understand, consist of albuminous material. If you introduce an egg into mercuric chloride, and if you thereby coagulate it, do you not take away its vitality?—Yes.

18,656. Does not the same thing, then, hold true of an albuminous microbe?—Yes.

18,657. Why do you think that the microbe retains its vitality in mercuric chloride solution?—The albuminous medium in which bacteria are held is attacked first, and precipitated, and thus the destruction of bacteria is prevented.

18,658. Supposing they are held in suspension in water?—Then they would be destroyed; but if they are in an albuminous medium they will not be destroyed.

18,659. You do not think bacteria will be killed if mercuric chloride is applied to a wall?—In such circumstances it would act.

18,660. If mercuric chloride solution was poured on a floor which contained bacteria, you do not doubt, do you, that it would destroy the bacteria?—It would, in the absence of albuminous material; but it should not be used in the ordinary brass or metallic syringes.

18,661. That is another objection?—Yes.

18,662. You do not doubt that these disinfectants have bactericidal power?—No, they have this power, provided no albuminous medium interferes.

18,663. You have an objection to Prof. Haffkine's vaccine?—Yes.

18,664. On the ground that bacteria in the vaccine are not dead, but dormant?—Yes.

18,665. I understand that you think the vaccine contains living plague microbes?—Yes, in a dormant state.

18,666. Have you taken steps to ascertain that it actually does contain these living plague microbes?—Yes, I have. I went to Prof. Haffkine's laboratory several times for the purpose. I was introduced to him a month back, and I was discussing the question with him. Prof. Haffkine calls them dead, inasmuch as their cultures in artificial media are found extinct. He has not satisfied me that they cannot crop up into activity in living animal systems.

18,667. You have, in your précis, made an assertion that the bacteria are still alive in the vaccine. What is the evidence upon which you base that statement?—The process adopted is not sufficient to kill bacteria.

18,668. What is the process adopted?—The serum is heated to about 50 or 60 degrees.

18,669. We have it in evidence that the fluid is heated to 65 degrees for an hour. Does that not suffice?—There are certain microbes that are not killed at that temperature.

18,670. Do you know as a fact that plague microbes are not killed at that temperature?—No, possibly they are not.

18,671. I thought you had made yourself responsible for the stronger assertion that the plague bacilli were actually alive in the vaccine?—Yes, alive in a dormant state. There are other circumstances also confirming this belief. The only explanation of propagation and communication by inoculation could be given only on the supposition of microbes not being killed.

18,672. What is the other evidence that makes you think the plague vaccine contains living plague germs?—The symptoms we observe in inoculated persons. There is a period of incubation.

18,673. What is the period of incubation?—About six hours or one day.

18,674. Do you mean that the symptoms which are produced by the vaccine do not come on for six hours?—Yes, the fever of inoculation; there must be some living microbes, and they would multiply.

18,675. That is how you explain the fact that six hours elapse before you get any symptoms?—If it was merely a toxine, or a chemical substance, the symptoms would probably supervene within an hour two.

18,676. Do you think that if you put a slowly soluble poison under the skin, you would have symptoms developed immediately?—I am talking of a readily soluble chemical substance.

18,677. Are you aware that the toxines which are contained in Haffkine's vaccine are not all in solution in that vaccine? Are you aware that many of the toxic substances are contained in the bodies of the bacteria? Do you think this fact might not readily account for the slow supervention of the symptoms of poisoning?—You mean they are insoluble?

18,678. Do you know what the contents of Haffkine's vaccine are?—Yes, they are the supposed dead germs and toxines.

18,679. Dead germs, I understand, require to be dissolved before their constituent substance could exert a poisonous effect on the system; is that so?—The so-called "dead" germs will act, without being dissolved, on their enveloping casing being dissolved.

18,680. Do you think that solid particles can act poisonously without being dissolved?—If the germs are dormant they might grow and multiply.

18,681. I understand that you think that the germs are living, and that the poisons are introduced in a soluble condition, and that it is therefore not a question of their requiring to be dissolved?—No, but if you separate the serum into two portions, we find that the supernatant fluid gives all the febrile symptoms. That is what I find in Prof. Haffkine's own statement.

18,682. I think we had it from Prof. Haffkine that he had not made experiments on the effects of the supernatant fluid alone?—I have got it here. The sediment is the cause of local inflammation, and the supernatant fluid is the cause of febrile symptoms. I find it in Dr. Bhalchandra's printed lecture, at page 4.*

18,683. Have you got your facts from Prof. Haffkine?—In my conversation I got this very explanation.

18,684. Have you any other reasons beyond the fact that the advent of the symptoms is delayed for six hours, for thinking that Prof. Haffkine's prophylactic contains living plague germs?—Yes; the communicability—the increased mortality among the uninoculated.

18,685. What evidence have you of increased mortality among the uninoculated?—The published statements of Prof. Haffkine show that uninoculated died in very large proportions, and such was not the case in any town where inoculation was not introduced.

18,686. Will you give us an instance? I think you refer to the case of Dharwar and Hubli. Do you know what the total mortality among the uninoculated was in those towns? What, for instance, was the total mortality in Hubli among the uninoculated?—I have not got the total.

18,687. Would you be surprised to hear that the total mortality among the uninoculated up to December was only 14 per cent.? Have you added the figures up?—No, I have not added the figures up. I think that is high enough.

18,688. Do you think that the 14 per cent. mortality which occurred among the uninoculated in Hubli is a higher percentage of mortality than has occurred in other places?—Yes.

* Not published with the Proceedings of the Commission.

18,689. Would you be surprised to hear that in villages round about Hubli where no inoculation had been done, mortality amounted to 28, 29, and 30 per cent.?—I am told several people went to Hubli to get themselves inoculated.

18,690. That is quite true. The total mortality among uninoculated in Hubli, which you said established your case, was 14 per cent. We have had it in evidence that round about Hubli, in the villages, mortalities of 28 per cent. were not uncommon where no inoculation was done. How does that agree with your theory that inoculation causes increased mortality among the uninoculated?—You are citing villages round Hubli, and there inoculations were performed.

18,691. We have had it in evidence that no inoculations were performed in the villages which are in question?—Captain Leumann states in his report* that he inoculated several hundreds and thousands coming from different villages round Hubli.

18,692. Do you think there is no greater mortality than 14 per cent. has been observed to occur from plague?—Sometimes it may be. I have not come across any instance of higher mortality in places untainted by inoculation.

18,693. Do you know what the mortality was in Dharwar among the uninoculated? You say there was an extraordinary high mortality; would you be surprised to hear it was 9·5 per cent.? The facts which you have in view are, I understand, the data which refer to the individual weeks. These facts were taken upon a census of the inoculated and uninoculated, and you think there was a large mortality among the uninoculated there?—Yes, I would be; because the Government Weekly Returns show a much higher rate than 9·5 per cent. This higher rate can be reduced to any extent by simply distributing the mortality over long periods.

18,694. Have you any evidence that the numbers of uninoculated are correctly given in the weekly report?—Approximately they must be true.

18,695. How do you know?—They are the census returns.

18,696. You cannot vouch, can you, for the accuracy of the figures of uninoculated given in the weekly returns?—They are supplied by Government Officers.

18,697. You have not totalled the figures up to find out what was the mortality among uninoculated in a sequence of weeks; the total as thus arrived at is very low, is it not?—Of course, the extraordinarily high mortality of those weeks during which inoculations have been performed in very large numbers, may be disguised by totalling up and taking the mean.

18,698. Have you totalled those figures up?—No, I have not totalled them up. The results arrived at by totalling would fail to give an idea of the true state of things. When the numbers of inoculated increase rapidly, we find the mortality percentage increasing.

18,699. Does it occur to you that many inoculations were performed where plague was very virulent, and that a large mortality of plague causes a large afflux of people to the inoculation stations?—The inoculations at Dharwar and Hubli were more or less of a compulsory character. There a rise in the epidemic did not lead to a rise in the inoculation figures, but the inoculation was the cause of the rise of the epidemic. I will give you an instance of Daman.

18,700. Where did you obtain your facts about Daman?—I have Prof. Haffkine's Report† here.

18,701. Would you tell us the facts that strike you about the mortality in Daman? What do the facts you propose to quote purport to show?—An increase of mortality among the uninoculated.

18,702. An increase as compared with what?—Compared with stations where no inoculations were introduced.

18,703. You mean there was a larger mortality in Daman among uninoculated than in any other place in India. Before you give us your facts, will you tell us what your facts are going to prove?—That an increase in inoculations produces an increase in mortality among the uninoculated.

18,704. Do you not think where an epidemic is severe more and more people would naturally offer themselves for inoculation?—How can such conservative people of this country know it for certain that inoculation would save them, and rush to avail themselves of such a novel and experimental measure? When an epidemic is violently raging they would, on the contrary, refuse to oppose the decrees of such a visitation of the Plague Deity.

18,705. If the epidemic increases in severity, do not you think that that increase will cause more people to be inoculated?—The epidemic cannot increase so very rapidly. In Hubli there was a jump.

18,706. Would you tell us the facts which you are going to give about Daman, and what they are going to prove?—Whenever inoculations were done, the mortality, which was on the decrease, jumped up. Twice it has been the case at Daman.

18,707. Would you prepare a table showing these facts, and send it in to us for a consideration?—Yes, the table is as follows:—

The number of inhabitants in Lower Daman were 10,900. Plague first appeared there in February 1897. In February and March nearly 2,000 people left the city, a cordon was established on the 23rd March, and the British territories were closed on the 30th March.

The First Series of Inoculations.—Between the 23rd and 25th of March 1897, 846 persons were inoculated, and 171 more between the 4th and 7th of April.

This was followed by the *worst period* of the epidemic. The climax was reached in the middle of April, the daily mortality rising to 80.

The Second Series of Inoculations.—529 persons were inoculated between the 17th and 27th April, and 99 more between the 24th April and 2nd May. It may be noted that these inoculations also had the effect of raising the mortality, the number of deaths on the 30th April being 38, and on the 4th May, 47.

The mortality began to decline in May, and dropped down to 6 and 8 on the 17th and 18th May.

18,708. You had two reasons for saying that bacteria were alive in Haffkine's fluid. One was that the symptoms do not appear till after an interval of six hours; the second reason you gave for your belief was the fact relative to the mortality among the uninoculated in Hubli and Dharwar. You now add Daman. Have you any further reasons for your belief?—Inoculation was also tried at Undhera, a village in the Baroda territory.

18,709. What was established by the experiments in Undhera?—All the deaths among the uninoculated took place within a week or so after the inoculation.

18,710. Does it occur to you, if you vaccinated against small-pox, and a small-pox epidemic was going on, you would not get your immunity immediately?—It may be so. But I am not referring to deaths among the inoculated. The many deaths that took place among the uninoculated were within a week or so after the inoculation, and although the uninoculated remained uninoculated, there were no deaths afterwards. The epidemic practically ceased after a fortnight after inoculation date.

18,711. You say all the deaths occurred among the uninoculated?—I say all the deaths among the uninoculated took place within a week after the inoculations were introduced—most of them, I do not say all; there were some few deaths after the first week or fortnight.

18,712. What do you deduce from that?—That there must be some connection between inoculation and the spread of plague.

18,713. Could not you account for the facts just as well by referring them to the epidemic that was raging at the time?—It could not rage in this particular way—that it goes up to its climax when the inoculations are in the highest proportions. I have noticed in several instances that when the number of inoculations was largest the epidemic was at its climax.

18,714. Would you pass on from that question. Have you any other reasons than those you have given us for thinking that there are live germs in the vaccine?—Yes, I have got several other facts. There are many houses in Bombay where no plague cases occurred before or after inoculation; but there were some cases just after the inoculation.

18,715. Does that prove that these cases were referable to the inoculation?—I think that these cases should be

* *See* App. No. XV. in Volume I. of the Proceedings of the Commission.

† *See* App. No. IV. in Volume I. of these Proceedings.

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referred to inoculation. There are many such occurrences.

18,716. If there was a wedding in a house, and a case of plague occurred afterwards in that house, would you infer that the wedding would have produced the plague?—It is not like that. This causal connection can be explained on a scientific basis.

18,717. You say that the facts compel to this conclusion. I say that a similar train of reasons would also compel you to the conclusion that the wedding in the house was the cause of the plague. You have an inoculation in a house, and a case of plague in another inhabitant of that house, and you argue that the case of plague is due to the inoculation. That is your argument?—That is not my argument.

18,718. Will you, then, state your argument?—I have reasoned this out on a scientific basis, and I have corroborated it by statistical data.

18,719. The facts, you say, force this conclusion upon you, that when an inoculation is performed upon one person, some other person in the house gets plague. Is the evidence you adduce any more conclusive than the evidence that can be adduced to prove that a wedding in a house is necessarily followed up by a case of plague in that house?—If there were a lakh of weddings followed by plague in every instance, I should certainly take it upon myself to see if any connection could be traced on a scientific basis.

18,720. But you did not say you had a lakh of cases in which inoculations in a house were followed up by the occurrence of plague cases; you said that there were *some* houses in which that sequence had been observed; have you made a census of those houses?—I have got it, but it is not complete. But, as far as it goes, it is sufficient to convince any reasonable man.

18,721. Have you any more *such* arguments, which you wish to adduce in favour of your views that the inoculations are a source of danger to the uninoculated?—In Hubli we find that there was an increase in total mortality. That is another way of looking at the same figures. The increase of the total mortality increased with the number of inoculations.

18,722. I asked you whether you thought that inoculation would not increase *pari passu* with the growth of an epidemic. Is not that the natural way to look at it? The more the danger from plague, the more the people would recur to inoculation. Is not that a simpler way of explaining these facts than that which you adopt?—The epidemic would not keep *pari passu* with the inoculations.

18,723. Do you think the vaccinations would not keep pace with the rise of an epidemic? Do you think if the mortality from plague to-morrow in Bombay was 1,000, and the day after that 2,000, that more people would not recur to inoculation?—No, I did not think so.

18,724. Do you think that it is the danger of being attacked by plague which causes people to come for inoculation? Do you think that if an epidemic of small-pox breaks out, it does not drive people to vaccination?—No. If it is produced by the vaccination, people would not come in for inoculation.

18,725. If what is produced?—If the rise in the epidemic was due to vaccination.

18,726. How do you know that? There are two explanations, either that the epidemic produces vaccination, or vaccination produces epidemic?—You mean to say the epidemic and the inoculation went up in the same proportion?

18,727. That is the fact which we have to explain. As plague increases, inoculations increase. You have that in every case of epidemic. For instance, when there is a large epidemic of small-pox, people get vaccinated in large numbers. Do you think that vaccination produces an epidemic of small-pox, or that the epidemic of small-pox produces vaccination? You think, do you not, that vaccination is effective in stopping small-pox?—Yes, I think it is.

18,728. Let us pass on to the question of iodine terchloride, which you mention in your précis. You have an idea that the antiseptics in use are useless?—More or less.

18,729. That they are useless therapeutically, I mean?—Yes.

18,730. You think the terchloride of iodine would be a better antiseptic than any of those which are at present in use?—Yes.

18,731. In support of this opinion, you can produce data showing that one in 1,000 of this terchloride would kill bacteria in a body?—Yes.

18,732. Have you calculated how much iodine terchloride would be required to produce a concentration of one in 1,000 in the body? What doses would you have to give to effect the destruction of microbes in the body?—Doses of 20 minims repeated every hour.

18,733. I have calculated it out, and I find that an ordinary man weighs 70 kilos, that is, 70,000 grammes: a concentration of one in 1,000 would only be obtained by administering to him 70 grammes of iodine terchloride?—Yes, if you would include also bones, muscles, &c. in your weight.

18,734. Seventy grammes is 2½ ounces. What is the sense of giving a dose of 20 *minims* when you want 2½ ounces to produce a bactericidal effect?—If we take the weight of the blood only, the quantity required would be 5 grammes to produce the full germicidal effect in one single dose; but we cannot give such large doses; but small doses will exert inhibitory action.

18,735. Have you any evidence to show that?—I have several letters with me in the vernacular to say that they used this, and that people were cured of plague in Belgaum, and other infected places.

18,736. You have two cases where marvellous effects were, you say, obtained in the Parsee Hospital. Do you think many marvellous cures are not effected also by Mother Siegel's Syrup?—That was the opinion of a medical man of a very good reputation.

18,737. Most medical men attribute marvellous results to most drugs?—I do not know. The late Dr. Bahadhurji tried many experiments, and Prof. Behring also used it. Iodine terchloride is his favourite drug.

18,738. This iodine terchloride was not discovered by you; it was discovered, was it not, in Germany?—Yes, it was.

18,739. Do you know whether it is used in the treatment of fevers in Germany?—I do not know that. It is used in dyspepsia and flatulence, and in diseases of gastric fermentation.

18,740. I am speaking about fevers. Did its inventor recommend it as a therapeutical agent which was applicable to the treatment of fevers?—It is on trial there. Prof. Behring uses it in diphtheria. I have got a standard authority for this information, namely, Stephenson and Murphy's Hygiene.

18,741. Are you aware that Prof. Behring, so far from prescribing iodine terchloride as a cure for diphtheria, has brought out an anti-toxine as a cure for diphtheria? If iodine terchloride was effective in diphtheria, do you think that Prof. Behring would have taken the trouble to seek out a new therapeutical method for diphtheria?—It is stated in the standard books. He is using it along with his serum for germicidal purposes.

18,742. (*Dr. Ruffer.*) You say that one of the arguments against using Haffkine's prophylactic is that there is a long incubation period between the time of injection and the first symptoms. Supposing you inoculate an animal with a small quantity of snake venom, how long is it before the first symptoms appear?—Probably an hour or two.

18,743. Are you aware that sometimes it takes as long as six or seven hours? I will take you to another point. I believe naphthaline is not a bacterial poison?—But it is an insoluble substance.

18,744. It is, but supposing you give an animal large doses of naphthaline, the animal goes blind after a time, does it not?—Yes, but it will take some time. I do not know how long.

18,745. You may take it from me that it takes several days; months even?—It is a most difficult substance to dissolve.

18,746. Are you aware that all bacterial toxines require a long incubation period before they act? Supposing you take a tetanus culture, and filter off all the bacteria, and inject the pure toxine into an animal, how long does it take before the first symptom shows itself?—From the authorities I find that these symptoms

must take place in an hour or two if the toxines are in a soluble form.

18,747. My experience is that it takes at least eight or ten hours, and that if you give an animal a thousand times the dose that would kill the animal, you see no symptoms for seven or eight hours. Supposing you inject a filtered culture of diphtheria toxine, how long is the incubation period?—I have not studied all these toxines.

18,748. I simply point them out.—You mean there are incubation periods for toxines.

18,749. Do not the bacteriological facts we know absolutely prove the opposite of your theory?—I have Klein's authority to prove that toxines should act within an hour or so, while sometimes Prof. Haffkine's fluid requires a day.

18,750. Does not the fact that a poison takes a long incubation period simply show that it is a bacterial poison?—Yes.

18,751. (*The President.*) Have you anything else you wish to lay before the Commission?—I have a chart here* showing the barometrical pressure and plague mortality. The mortality goes *pari passu* with the rise in barometric pressure. That explains that environment (the sewer gases) has much to do with the plague. In summer we find the barometric pressure very low, and then the soil and sewer gases do not come up; while in winter, when the barometric pressure is at its highest, the warm moist gases come up. Owing to these emanations the germs acquire their pathogenic functions, and the virulence is greater.

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18,752. Have you taken into account the fact that in cold weather people crowd into their rooms, and that, therefore, infection may be greater?—Crowding is rife throughout the year.

18,753. But it is greater in cold weather?—Yes, people shut up their windows and doors, but then that probably explains my theory as well, that gases are accumulated in those places, and that the air is injurious.

*Not published in the Proceedings of the Commission.

(Witness withdrew.)

Mr. W. C. Shepherd, I.C.S., called and examined.

Mr. W. C. Shepherd, I.C.S.

18,754. (*The President.*) I believe you are Assistant Collector at Thana?—Yes.

18,755. Have you acquired your plague experience entirely there?—Yes.

18,756. What is your experience with regard to the source of infection?—Generally in Thana, as far as I have been able to make out, the source of infection has been some infected person coming from Bombay.

18,757. You think it has been carried by human agency?—Generally by human agency; but in some cases rats appear to have died before any case occurred in the village.

18,758. In some cases it has been introduced into the locality not by human agency, but by rats?—It seems so in one or two instances.

18,759. How far have rats proceeded from the nearest infected area in the cases you have referred to?—There was one case in which the nearest infected area was certainly three miles away, possibly four.

18,760. Can you entirely exclude human agency in that instance?—No, I could not in any instance. Our information was so inaccurate at the beginning of the epidemic that I could not lay any stress upon it. I do not know anything about the way rats travel. I believe they travel long distances.

18,761. There are, at any rate, human conduction and rat conduction?—Yes.

18,762. Have you any evidence with regard to the way plague can be conveyed by clothing or dead matter?—No.

18,763. I think you have had a good deal of experience with regard to plague measures?—Yes.

18,764. Firstly, with reference to evacuation, what is the opinion you have formed from your personal experience?—In every instance where evacuation has been carried out the plague has afterwards decreased. The effect of evacuation appeared to depend upon whether it was immediate or whether it was delayed. When it was delayed the plague mortality was greater than when it was carried out immediately.

18,765. Will you give us the number of cases before total immediate evacuation, and the number after; also, if possible, the number which occurred 10 days after evacuation, so as to exclude those who had been already infected?—(Witness subsequently explained that he could not give any reliable statistics.)

18,766. The general result has been that wherever total evacuation has been speedily accomplished in a growing epidemic the epidemic has decreased rapidly, and then has ceased in a short time?—Yes.

18,767. Have you largely made use of disinfection?—Yes.

18,768. And what views have you formed with regard to its value as a plague measure?—I have stated in my précis of evidence that I had no reason to suppose that it produced any good result; but I do not think I ought to have said that, because, as a matter of fact, disinfection has been carried out in almost every case I have had anything to do with. I can point to no instance in which disinfection clearly produced an effect upon plague, but as disinfection was always resorted to, I am not in a position to say what would happen if it were dispensed with. My objections were based largely on the ground that it was so badly done that it could not be of any value.

18,769. It was insufficient because it was done so badly?—Yes.

18,770. Can you describe how it was done?—The disinfection was almost entirely done with perchloride of mercury. We used syringes of different kinds, metal and wood. We washed the walls and floors of the houses with the perchloride of mercury as well as we could. That is the disinfection I saw myself. I have reason to believe that when there was no officer to supervise it it was not properly done, *i.e.*, the walls and floors were not thoroughly washed with the solution.

18,771. But I suppose you saw it sometimes properly done?—Yes.

18,772. What was the result in those cases?—I have never had an instance in which I could say it produced any result at all.

18,773. Did plague re-appear in properly disinfected houses?—In the next epidemic. I do not wish it to be assumed that I call the system of disinfection I used "proper" disinfection, all I mean is that my object was to thoroughly wash the inside of an infected house with the disinfectant, and when I was present I saw that it was thoroughly washed.

18,774. But plague did not reappear quickly, not until after a considerable interval?—As a rule, nobody was allowed to go into the houses for two or three months after they had been disinfected.

18,775. You disinfected the houses; did you do anything more to the houses before the people were allowed to enter them?—We took off a good many tiles, and opened the windows where we could.

18,776. Had you any recurrence of plague in the houses you treated in that way?—I know of no case of recrudescence except as part of a general recrudescence.

18,777. You had some experience of this matter, I believe, in Bassein town?—Yes.

18,778. What?—Bassein town is an exceptional case, because it appears that, in Bassein, there was a permanent source of infection, that is to say, it appears that there were two or three epidemics, and in each epidemic the first infection came from one particular place.

18,779. Had this particular place been disinfected?—Yes, it had been disinfected over and over again.

18,780. You bring that forward as an example of the inefficacy of disinfection?—Yes, I do.

18,781. Have you any opinions to offer with regard to segregation?—In dealing with villages I think it is unnecessary, except to the extent of putting the people who are sick and their immediate relatives in huts at some distance from the others.

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18,782. Therefore you think that partial evacuation may succeed?—It may succeed where the infected block is separated from the rest of the village; but, as a rule, I have found that plague cases occur in all parts of the village almost directly after it has been first infected.

18,783. Does the case of the Bassein Koliwada which you refer to have any bearing upon this matter?—I referred to the Koliwada as being an infected locality.

18,784. What do you think is the maximum size of a town in which complete evacuation could be effectively carried out?—It depends entirely upon the locality. If you had a wide plain which you could take up without much expense, you could evacuate a whole town of almost any size. There is no absolute impossibility about it.

18,785. Practically, there is no limit?—Practically, I should say there is no limit except that of expense.

18,786. Taking the towns one finds in India, about what is the maximum sized town that could be evacuated?—In the Thana district it could be very difficult to evacuate a large town because the country does not admit of it, it is all cut up into small fields, there is much broken ground and wooded country.

18,787. What is the largest town?—You could evacuate a town of 10,000 or 11,000 inhabitants in most parts of the district.

18,788. Did you find much resistance offered by the people?—Not so far as evacuation is concerned. We used to have considerable resistance to segregation. It was very unpopular indeed. That is one reason upon which I base my objections to it.

18,789. (*Mr. Hewett.*) What is your reason for thinking that dissemination by contact with infected persons is so rare that it may almost be ignored?—If dissemination was chiefly by contact, considering the way the people live in the villages, we should get a certain class of people infected first. If it began among a certain caste, several members of that caste would be infected before others; but, as a matter of fact we do not find that to be the case.

18,790. Is it your experience that people living close together, and having dealings with one another, do not get infected?—No, they do get infected, but people who do not have dealings with one another also get infected in the same town.

18,791. Do you find that neighbouring houses get infected in the same town?—Sometimes yes, and sometimes no. It varies. I could not give any general rule.

18,792. You said that mortality among rats generally occurred before you got a local case of plague?—That is my belief.

18,793. But are you certain that it occurred before you had an imported case?—I am certain that in some cases mortality among rats occurred before an imported case was reported.

18,794. Can you exclude the possibility of there having been an imported case?—Our information is so inaccurate before an epidemic that it is impossible to exclude that.

18,795. Do you think that it is likely that rats get infected from an imported case and then move plague about in a local area?—That seems to be the probable way in which it is spread in most of these villages, because it comes up in all sorts of places instead of following a regular course.

18,796. (*Mr. Cumine.*) You spoke of recrudescence, and said that you do not know of any recrudescence except as part of a general recrudescence. Did any case come under your notice where, apparently, an old germ, after lying quiescent for some time, woke up into activity again? Is that what you mean by general recrudescence?—No; by general recrudescence I mean when plague had stopped in a village it did not begin again except in the course of a general recrudescence of plague all over that district.

18,797. When plague began again in a village was that due to a secondinfection or to an old germ?—As a rule it was possible to trace it to the second infection, except in the case of Bassein which I quoted.

18,798. When villages or towns became infected a second time did the plague seem to reappear in the same houses?—Sometimes it did actually in the same houses where it appeared at first. Sometimes it did not. I can think of one case where it did undoubtedly, and another case where it began in the same part of a town, though perhaps not exactly in the same houses.

18,799. In this case where it began in the same house, or in the same part of the house, could you trace any re-infection from outside? Could you be certain that there was no re-infection?—No, I could not possibly be certain.

(Witness withdrew.)

Mr. E. L. Marsh.

Mr. Ernest L. Marsh called and examined.

18,800. (*The President.*) I believe you have been engaged in bacteriological work?—Yes.

18,801. (*Dr. Buffer.*) I think you have been making some investigations as to the approximate numbers and varieties of micro-organisms recovered from samples of soil and dust from native dwellings?—Yes.

18,802. How did you take the samples of the soil in rooms?—I took samples from the surface of the earthen floor.

18,803. How deep?—The immediate surface, *i.e.*, scrapings from the surface. I collected the samples in sterile tubes, and carried the tubes immediately to the laboratory. Then one hundredth of gramme of the sample was inoculated into melted agar.

18,804. How did you weigh it?—I did not weigh the quantity actually examined. I first weighed a control quantity, and from its bulk I estimated the amount to use for the purpose of bacteriological examination. This amount was removed on the end of a sterile platinum rod furnished with a scoop of known capacity. I found that the method of estimation was sufficiently accurate. The estimated one-hundredth gramme was immediately added to a test tube containing 10 c.c. of melted agar. By shaking it it was distributed as evenly as possible through the agar, which was then spread over the surface of a Petri plate to solidify. The plates were incubated at the temperature of the room for 24–48 hours, when the number of colonies which had developed in the agar in the plate, and in the agar remaining in the emptied test tube were counted. Agar was employed because of its suitability as a solid nutrient material at the comparatively high temperature of the laboratory (80°–86° F.). For this reason alone the number of colonies counted is probably much lower than might have been obtained with gelatine had it been practicable to use that medium.

18,805. Can you give us the general results of your investigations in unoccupied and occupied rooms?—The houses examined were not necessarily plague infected houses; some of them were. I took samples from two unoccupied houses. One of these houses was in the servants' quarters in a bungalow on Malabar Hill, the other was in a plague district in Bombay. The highest number of colonies in one sample was 5 million odd (calculated for 1 gramme of the sample); the lowest number in a sample from these two houses was 8 thousand odd, while the average of 22 cultures from 22 samples was one million odd. These results were obtained for unoccupied houses. From occupied houses the highest number from any one sample was 8 million odd, and the lowest number from any one sample was 126 thousand odd. The average was 3 million odd.

18,806. So that there is a rather larger number of micro-organisms in the occupied houses than in the unoccupied houses?—Yes.

18,807. Were they the same kind of floors?—Yes.

18,808. In the same quarter of the town?—One of the unoccupied houses was in the servants' quarters in a bungalow on Malabar Hill. The other house was in a plague district.

18,809. What did you find in the disinfected and unroofed houses?—In the two disinfected houses examined the highest number of colonies in any one

sample was 4 million odd. Two samples were sterile. The average of 25 cultures from 25 samples was 1 million odd.

18,810. So that it was very much lower than in the occupied houses?—Yes.

18,811. How had the houses been disinfected?—With perchloride of mercury.

18,812. Did you take any steps to neutralize the perchloride when you made your agar plates?—No.

18,813. There might have been some perchloride of mercury sticking to the sample?—There might have been. I thought I would give the sample all the advantage of the fact that it had been treated by perchloride of mercury.

18,814. How long after disinfection were your examinations made?—The samples were collected and the examinations made from within a few hours to four days after disinfection.

18,815. What did you find in unroofed houses?—I examined one, and the highest number of colonies in one sample was 1 million odd, and the lowest number was 2,000. The average was 500,000.

18,816. What conclusion do you draw from that?—That the average number of colonies of micro-organisms in 25 cultures from 25 samples from disinfected houses was 25 per cent. less than the average number of colonies in 22 cultures from 22 samples from unoccupied houses, and 65 per cent. less than the average of 20 cultures from 20 samples from occupied houses.

18,817. What was the nature of the microbes you found?—They were in great variety. The spore-bearing organisms were the commonest.

18,818. In all the samples could you give us the exact result of what you found?—The majority of bacteria recovered from the various samples were obligate saprophytes, dealing with oxidation, nitrification, and formation of carbonic acid of the dead and decaying matter in the filth of the houses. A large number of the samples contained species of the more sensitive facultative parasites. Divided into spore-bearing and non-spore-bearing forms the following account may be given:—Spore-bearing: B. subtilis, B. mycoides, B. vulgatus, B. mesentericus, B. butyricus; Non-spore bearing: B. coli communis, and other species of the coli group; Bac. vulgare, and other species of proteus; Bac. acidi lactici, Bac. fluorescens, Bac. syncyaneum, Bac. prodigiosum, Bac. janthinum, Bac. pyocyaneum, Micro. candidans, Micro. agilis, Micro. luteus, Micro. pyogenes aureus, citreus, and albus, streptococcus pyogenes, staphylococci, sarcinæ, moulds, yeasts. The spore-bearing species were ubiquitous, and in a great preponderance.

18,819. Did you find any difference between the number of the spore-bearing and other organisms in disinfected houses?—I cannot give you exact figures.

18,820. What is your impression?—My impression is that I found a greater number of spore-bearing organisms in disinfected houses.

18,821. That is simply an impression; you have no actual numbers?—It is a very strong impression.

18,822. So that perchloride of mercury and whitewash would kill off most of the non-spore-bearing organisms and leave the spore-bearing organisms?—Yes.

18,823. Are the spore-bearing organisms mostly non-pathogenic?—Yes.

18,824. It would not matter very much whether they were left alive?—No; my method of culture, however, only allowed me to recover the aerobic micro-organisms; it only deals with the aerobic micro-organisms.

18,825. How did you collect the dust on the floors or walls?—The samples from the floors included dust, cow dung, and dirt.

18,826. What result did you get from the dust on the walls of unoccupied and occupied houses?—The results are included in the statement I have given.

18,827. You mixed the two together, the soil and dust?—Yes. I took 14 samples, as a rule, from each house. The majority of the samples were from the floor, but three or four samples would be taken from the walls.

18,828. I believe you have made experiments with bubonic microbes and cow dung; could you give us the particulars of your experiments?—In carrying out this series of experiments the object was to reply to a letter received by M. Haffkine from Mr. Cumine, in August, with regard to the action of perchloride of mercury on cow dung and cow dung floors. In conducting the series of investigations, I tested the samples of perchloride of mercury against sterile cow dung to discover what effect sterile cow dung had in neutralizing a solution of perchloride of mercury. In the experiments of Mr. Hankin and Dr. Pitchford, perchloride of mercury dissolved in sterile water in the proportion of 1 in 5,000 caused the death of a pure culture of the plague micro-organism after one minute's contact. I found that by adding to 10 c.c. of perchloride of this strength a quantity of cow dung equal to 2 grammes or more, the disinfectant no longer existed; it was neutralized.

18,829. Will you give us the details of your experiments upon that point?—A series of test-tubes containing from ·5 gramme to 5 grammes of sterilized fresh cow dung in the form of dust was prepared. A measured quantity of sterile distilled water containing perchloride of mercury in solution was added to the tubes, so that each tube held the test amount of cow dung mixed with 10 c.c. of water containing ·002 gramme of perchloride of mercury, or a proportion of 1 in 5,000. At the same time each tube received a glass bristle wetted in its lower third by a thin film of living culture obtained from the surface of a three days old agar growth of plague. The experimental tubes were kept at the temperature of the laboratory for 18 hours. At the end of this interval the glass bristles infected with plague were withdrawn from the paste of cow-dung and perchloride solution in the different tubes, washed in a weak solution of carbonate of soda, and inoculated *seriatim* into tubes containing 20 c.c. of nutrient broth. The culture tubes were incubated at the temperature of the laboratory for ten days, and their ability to produce fresh culture of the test organism was as follows:—

Gramme of Perchloride of Mercury in 10 c.c. of Distilled Water.	Amount of sterilized Cow Dung acted upon.	Growth in Broth after 18 Hours attempted Disinfection.
·002	·5 gramme.	—
,,	1·0 ,,	—
,,	1·5 ,,	—
,,	2·0 ,,	—
,,	2·5 ,,	+
,,	3·0 ,,	+
,,	3·5 ,,	+
,,	4·0 ,,	+
,,	4·5 ,,	+
,,	5· ,,	+

I found that tubes containing quantities of cow dung of 2 grammes and less were disinfected, but those containing quantities of cow dung above 2 grammes were not disinfected of the test organism.

18,830. That was a neutral solution of perchloride of mercury?—Yes, an aqueous neutral solution.

18,831. Did you make any experiments with an acidified solution?—Yes.

18,832. Could you give us the particulars?—I have not done an experiment in which the results might be compared with the results just stated, but in my next experiment I used a solution of the formula and the strength commonly used in Bombay, viz., one in 725, 1015, and 152 of perchloride of mercury, chloride of ammonia, and hydrochloric acid respectively.

18,833. You made it up yourself?—I made a control sample myself, and I got a sample from one of the disinfection officers in Bombay and compared them one with the other.

18,834. What were the results?—They are detailed in the following experiment. Two series of test tubes containing from ·2 gramme to ·8 gramme of cow dung (weighed dry) were prepared. A measured quantity of the test solution was poured into the tubes so that each tube held the test amount of cow dung wetted with 10 c.c. of the disinfectant solution. Care was taken to thoroughly wet the cow dung with the solution, 10 c.c. of which should moisten dry cow dung in a fine state of division up to five grammes. At the end of 18 hours a minute quantity of the cow dung was

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abstracted and inoculated into nutrient broth. The results obtained were as follows:—

Gramme of Perchloride of Mercury in Solution with Chloride of Ammonia and Hydrochloric Acid in 10 c.c. Water.	Amount of unsterilized Cow Dung acted upon.	Growth in Broth after 18 Hours' attempted Sterilization.	
		Control Solution.	Bombay Solution.
	Grammes.		
·014	·2	—	—
"	·3	—	—
"	·4	—	—
"	·5	— — —	— — +*
"	·8	— — +*	+ +
"	1·0	+ +	+
"	1·5	+	+
"	2·0	+	+
"	2·5	+	+
"	3·0	+	+

* Spores of moulds and of bacillus megatherium, B. subtilis, and B. mycoides obtained from the unsterilized cow dung. Whenever equivocal results seemed to be obtained the tests were repeated.

This experiment also shows the comparative results obtained with a laboratory prepared solution and a sample of the solution obtained from disinfection officers in Bombay.

18,835. Kindly give us that?—It is expressed in the statement that ·5 gramme of ordinary cow dung can be efficiently sterilized by 10 c.c. of the laboratory solution, but not by the other solution. The sample from the plague officers showed a very slight difference however.

18,836. What was the difference?—A difference measured by the fact that the laboratory solution sterilized ·5 gramme. The plague officers' solution did not sterilize that but sterilized ·4 gramme.

18,837. A difference of 20 per cent.?—Yes.

18,838. What other experiments have you made?—The experiment which has just been mentioned was repeated in all its details with living cultures of the plague bacillus as the test organisms. Each tube received in addition to the cow dung and disinfectant solution a glass bristle infected with a culture of the plague microbe recovered from a broth culture 15 days old. Care was taken to wash the bristles in sterile water to remove the adherent broth before inoculating them into the test tubes. On withdrawing the bristles at the end of the experiment they were first washed in sterile water made faintly alkaline with carbonate of soda, then agitated in melted agar, and finally plated from a second tube of melted agar for observation and recovery of the test organisms. Although this method of differentiating and identifying the test organism is not a delicate one, still, in the absence of animal inoculation tests, it appeared the most satisfactory one to employ. The use of broth is very unsatisfactory, owing to the rapid vegetation of the common saprophytic micro-organisms. In those instances where the results seemed to fall short of accurate demonstration the tests were repeated. The results obtained were as follows:—

Gramme of Perchloride of Mercury in Solution with Chloride of Ammonia and Hydrochloric Acid in 10 c.c. Water.	Amount of unsterilized Cow Dung acted upon.	Growth of the Plague Bacillus after 18 Hours attempted Disinfection.	
		Control Solution.	Bombay Solution.
·014	·2	—	—
"	·3	—	—
"	·4	—	—
"	·5	—	—
"	1·0	—	—
"	1·5	— —	— — —
"	1·75	— — —	+ — +
"	2·0	— — —	— + —
"	2·2	+ — +	— + +
"	2·5	— + —	+ + +
"	2·8	+ + +	+ + +

The results show a small success of the control solution over the Bombay solution, the latter being capable of a germicidal action on 1·5 grammes of cow dung experimentally infected with the organism of plague, the former a similar action on 2 grammes.

18,839. You refer to the action on the plague bacillus?—Yes, as the test organism in this experiment. The results were attained by 10 c.c. of a solution of 1 in 725 strength, an acidified solution.

18,840. In that case the sublimate would have to go through a considerable layer of cow dung before it got to plague bacillus? That is not quite the condition of nature, is it? There would be a layer of, say, a quarter of an inch of cow dung between the plague bacillus and the sublimate?—Not so much as that. The glass bristle was inserted into the mass of cow dung, and the cow dung was thoroughly moistened with the disinfectant. It is just as likely that the disinfection was in contact with the glass bristle as with any of the cow dung particles.

18,841. Do you moisten the cow dung before you put the bristle in?—No. I put the bristle into the cow dung first, so that the results may not be varied by the action of the cow dung in neutralizing part of the disinfectant. Then immediately afterwards it was moistened with the disinfectant.

18,842. It was simply moistened?—It was made wet. 10 c.c. very thoroughly moisten quantities up to 2 grammes of cow dung. In fact, 10 c.c. will moisten 5 grammes.

18,843. Have you any other experiments on that point?—I took samples scraped from the surface of native floors and used them as the test material.

18,844. In plague houses?—Yes, houses which had been notified to me by a plague officer.

18,845. Do you put in all those experiments?—Yes. In these experiments the Bombay solution was further tested. Instead of ordinary cow dung the test material employed was dried mud and cow dung dust scraped from the floors of native dwellings. The results obtained are detailed in the following experiment on the germicidal value of a sample of perchloride of mercury used in Bombay for disinfecting native houses:—

Amount of Earth and Cow Dung acted upon.	Growth in Broth after 18 hours attempted Sterilization.
·2 gramme	— —
·3 "	— —
·4 "	— — +*
·5 "	+ + +
·6 "	+ +
·7 "	+ +
·8 "	+ +
·9 "	+ +
1·0 "	+ +
1·5 grammes	+ +

* Spores or moulds and of B. megatherium, subtilis, and mycoides, were commonly obtained from the unsterilized material.

From the results it would appear that an amount of earth and cow dung from the floor of a native dwelling over ·3 gramme is not efficiently sterilized by 10 c.c. of a solution containing perchloride of mercury in the proportion of 1 in 725.

18,846. Is it sterilized as far as non-sporing organisms are concerned?—I failed to recover any non-sporing organisms in less than ·7 gramme of the test material.

18,847. Have you ever tried the following experiment, to put plague microbes in cow dung floor, pour the solution on it, and see then whether the plague is not destroyed?—I have not done an experiment actually in that way, but I have done one with pieces of a cow dung floor kept as samples in the laboratory.

18,848. Will you give us that experiment?—I took a 4-inch square of dry cow dung floor, and inoculated the surface with plague micro-organisms contained in a watery emulsion made from an agar culture. Then I poured on the surface of the piece of floor 10 c.c. of the 1 in 725 solution, and after 20 minutes took a scraping from the treated surface, which I inoculated into agar for plate cultivation of the plague bacillus, but failed to recover the organism. I also inoculated an animal with negative results.

18,849. In all these cases I do not quite see how you neutralized the perchloride of mercury; was it simply by a carbonate of soda solution?—Yes.

18,850. By a weak alkali?—Yes.

18,851. By that weak alkali you would neutralize the acid, but you would not neutralize the mercury, would you?—Yes.

18,852. My difficulty is, that perhaps your results are too good. I should have thought that if you put a certain amount of mercury with a plague microbe into a tube, unless you took some special measures to neutralize the disinfecting action of the perchloride of mercury, you would have a sort of film of perchloride of mercury round your microbe, which might prevent it growing?—I tried by means of a weak alkaline solution of carbonate of soda to neutralize the mercury.

18,853. Have you any experiments bearing on that?—No personal experiments.

18,854. My objection is probably quite fallacious; I only suggest it?—I think that experiments have been done, because when perchloride of mercury is used in very strong solution as a disinfectant it is the practice of the disinfectors in certain places to follow up the use of the mercury salt with a solution of carbonate of soda with which to neutralize it.

18,855. What other experiments have you got?—The last experiment was repeated with living cultures of the plague organism, the test material being scrapings of the floors of native houses. The results showed that ·8 gramme of earth and cow dung from the floor of a native dwelling is not efficiently sterilized by an acid solution of perchloride of mercury of the strength of 1 in 725.

18,856. As far as the plague microbe is concerned?—Yes.

18,857. How did you do it in the experiment with the dust; did you ram the dust down to the bottom of your tube? How did you mix the plague microbe with the dust?—I still used the glass-bristle method.

18,858. Was the dust loose or firmly bound together?—It was loose cow dung dust; it was ground down in the form of a powder.

18,859. Have you any other experiments?—I took the reaction of the disinfectant solution after contact with several quantities of cow dung and earth floor, and found that, while a control sample of the disinfectant solution always gave a strongly acid reaction, within two minutes' contact with 2 grammes cow dung and earth the reaction was affected to such an extent that it was only acid, no more than acid, with ·5 gramme the reaction was neutral, and with ·9 gramme the reaction was alkaline.

18,860. You want to add a considerable amount of acid to your solution?—Yes. From half to three-quarter per cent.

18,861. Have you any further experiments on cow dung?—No.

18,862. What conclusion do you draw from your experiments?—I concluded that 10 c.c. of an acid solution of the strength of 1 in 725 (Bombay formula) efficiently disinfects 1·5 grammes of cow dung experimentally infected with the organism of plague, but does not suppress the more resistant saprophytic bacteria. I also concluded that 10 c.c. of the 1 in 725 acid solution efficiently sterilizes ·7 gramme of cow dung floor experimentally infected with the organism of plague. It also reduces the number, but does not suppress the more resistant saprophytic bacteria. Also that as the effective limit of the 1 in 725 acid solution, in regard to disinfection against plague, is represented by the action of 10 c.c. of the solution on ·7 gramme of cow dung floor, and as ·7 gramme of cow dung floor is the amount commonly recoverable from 4 square inches of the earthen floor of a native house when the immediate surface for a depth of $\frac{1}{16}$ of an inch is removed, then 100 square feet (14,400 square inches) would yield 2,520 grammes, which amount of surface material would require approximately 8 gallons (three bucketfuls, the buckets being of a capacity of $2\frac{1}{2}$ gallons—many of the wooden buckets in Bombay have a capacity of only $2\frac{1}{2}$ gallons) of the 1 in 725 acid solution to vitally damage any contaminating plague micro-organism. But if the infectious material were below the immediate surface under disinfection, or on the surface protected by leaves, bits of rag, &c., then with such an application it could hardly be hurt at all. In a test observation in which 8 samples of dirt and cow dung from a room were examined before disinfection, and 12 samples from the same room immediately after disinfection, and in which care was taken that the quality and amount of perchloride of mercury used and its method of application allowed a 1 in 725 acid solution to produce its maximum effect, a comparison of result showed that while 4,057,800 was the average number of colonies of micro-organisms recovered from 1 gramme of each sample before disinfection, the average number after was 228,300—a reduction of about 94 per cent.

18,863. That is counting both sporing and non-sporing organisms?—Yes.

18,864. Then you have some experiments on the microbes of bubonic plague in relation to earth?—Yes.

18,865. What are your experiments with regard to the microbe of bubonic plague and sterilized garden mould?—That in sterilized mould it can have a continued existence up to 13 days.

18,866. How did you perform that experiment?—I took quantities of garden mould and sterilized it in test tubes in an autoclave, and made sure that it was sterile by control experiments. Then I inoculated the sterile earth with a culture of plague micro-organisms taken from the surface of an agar tube, and I also introduced a glass bristle infected in the same way as I have already described in the former experiments. At the end of intervals of from 1 to 13 days or more a glass bristle was removed from the sterile earth and inoculated into a culture tube of broth, and also a quantity of the earth itself was removed at the end of a platinum loop and inoculated into another series of broth tubes, and the results obtained culturally.

18,867. Did you make any experiments in unsterilized garden mould?—Yes. I got the plague micro-organisms to live in unsterilized garden mould from 4 to 6 days.

18,868. Do you think your experiment is quite a fair one? Supposing you put the plague bacillus sticking to the bristle, it is not in the same condition as if it were mixed with garden earth, is it?—With sterile media it really did not matter. I got the plague micro-organism from particles of the sterile media. With unsterilized media it was very difficult to recover the organism unless I adopted that method along with other methods. While the glass bristle method yielded these results, the results when I took a particle of non-sterile medium were very unsatisfactory. Owing to the difficulties that had to be overcome in the bacteriological proof of a few plague germs where there were crowds of saprophytic organisms, I could not be sure of them.

18,869. Were you able to isolate the plague bacillus again when you mixed it with unsterilized garden mould?—Only up to the length of time mentioned.

18,870. When you mixed it thoroughly with the garden mould, not with a glass bristle, but in a dish or tube, and powdered it all up together, could you then isolate the plague bacillus again?—I have done so up to short intervals.

18,871. It is a very difficult thing to do, is it not?—Yes.

18,872. Is it a matter of weeks?—Yes; it is very difficult.

18,873. Then it is very doubtful that you would get it in all cases, is it not?—I never used that method, because of its difficulty, when I wished to test if the organisms were alive for longer periods than 24 hours.

18,874. Have you given us all your experiments on earth and cow dung?—No. I have made laboratory experiments on sterile earth, sterile tap water, and sterile cow dung. I found when the plague microbes were inoculated into these materials that the conditions were favourable to their continued existence up to 13 days, 44 days, and several months respectively.

18,875. How much culture did you add to the sterilized tap water?—I did it in the way already described, with a glass bristle—the amount that would adhere as a delicate film to about one-third of the length of a glass bristle about 3 inches long.

18,876. Bombay tap water?—Yes, sterilized.

18,877. (*Prof. Wright.*) How long did the plague bacillus live in cow dung?—It lived several months in sterile cow dung.

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18,878. Is that moist cow dung?—Yes.

18,879. Wetted with Bombay water?—Yes, and sterilized.

18,880. (*Dr. Ruffer.*) How long did it live in non-sterilized cow dung?—Never after six days.

18,881. How about sterilized tap water?—The period was 44 days.

18,882. And in ordinary tap water?—Never after six days.

18,883. When you recovered it from water how did you make sure it was plague bacillus in the ordinary water?—I did animal control experiments.

18,884. (*Prof. Wright.*) Was the plague bacillus virulent after that time?—Yes. It was not virulent in the sense that it always killed the animal, but of a series of animals some sickened, and some of the sick died of plague.

18,885. (*Dr. Ruffer.*) Have you any other experiments on water?—No.

18,886. Have you any experiments with the microbe of bubonic plague in relation to dessication in sterilized air and ordinary air?—I did some experiments simply to find out how long the plague micro-organisms would live on glass bristles in ordinary air and in sterile air. I found in exceptional cases they lived as long as 48 hours on the glass rods. I inferred that that was due to the fact that there was probably a thicker film on the glass rod than usual.

18,887. Did you try sterilized articles of clothing inoculated with the plague microbe?—Yes.

18,888. How long does it live in them?—Never longer than 18 hours.

18,889. How did you expose your sterile clothing: did you put it away in the dark or hang it in a room?—I exposed it in a sterile chamber.

18,890. Did you dry it or keep it moist?—I kept it dry.

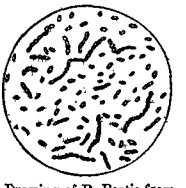
18,891. Then the desiccation may have acted?—Yes.

18,892. Have you made any experiments such as contaminating a shirt or a vest with the plague, and then rolling it up in the usual way in which you would send it to the wash, and then put them away in a drawer?—No, I have not.

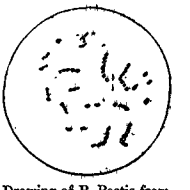
18,893. Have you any facts with regard to the growth of the plague micro-organism in ground air, and in artificial admixture of certain gases and ordinary air?—Yes. A series of six ordinary test tubes containing a four days' agar growth of plague (obtained from broth culture three days old, from a previous broth culture 10 days old, from an agar culture direct from bubo in a case of plague) were buried 9 to 12 inches below the surface of the soil in Bombay on January 3rd 1899.* The place of burial for two of the tubes was the earth of the floor of a native house, the remaining four tubes being buried in garden mould in the open. Control tubes containing cultures of the same age and pedigree as the above were kept in a dark cupboard in the laboratory. The tubes buried in the garden mould were allowed to remain undisturbed for 9, 23, and 28 days respectively. Of two tubes removed at the end of nine days one was discovered to be invaded by mould-fungi. The other tube was pure. This tube presented a slightly exaggerated growth of plague when contrasted with the control tubes kept in the cupboard. In the tubes removed after 23 and 28 days burial the growths were notably exaggerated. The appearance of the culture viewed by obliquely transmitted light was not the simple ground glass appearance of the control tubes, but that of a thick opaque growth. At a number of points the growth had developed what looked like secondary colonies, of a dull waxy appearance. These colonies had regular margins, and stood out well from the original arrangement of the growth. Stained specimens from the last two tubes showed under the microscope (× 800) bacteria of consistent shape and much larger dimensions than the average. The bipolar arrangement of the protoplasm was defined with unusual distinctness for an agar culture. A still more noteworthy feature was the presence of chain formations. As many as 20 to 30 individual bacteria were commonly counted in the chain fragments visible in the field. The chains were not exactly comparable to the short streptococcus-like growths obtained from a bouillon culture of plague made alkaline with carbonate of soda. They were stouter, and showed the bipolar markings of the individual bacteria in a prominent manner. A number of the chains presented an appearance of striation due to the presence of vacuoles. In the two growths buried in the floor of a native house for 23 days similar cultural and microscopical appearances were obtained. The occurrence of vacuolation in the elements of the chains was perhaps less marked.

Inoculated into broth, typical and vigorous growths occurred in each instance.

One drop of a broth sub-culture (24 hours old), from one of the agar cultures buried in the soil of a native floor, injected subcutaneously into a white mouse caused death within 18 hours. A similar dose of a broth sub-culture from a control tube was fatal after 50 hours.



Drawing of B. Pestis from an agar culture buried 23 days, 9 inches below surface of soil.



Drawing of B. Pestis from from a four days' broth culture made alkaline with carbonate of soda.

The above series of facts would seem to indicate that soil-air is possessed of conditions that are at least favourable to the growth and multiplication of the plague micro-organism. As the results obtained suggest that the dilution of the oxygen in ground air by carbonic acid is advantageous to the vegetation of the organism, a series of experiments was done in order to reproduce roughly similar conditions in the laboratory. The amount of carbonic acid in ground air being on an average from 2 to 3 per cent., or about 1 per cent. less than the amount in air expired from the lungs, an admixture of air and carbonic acid in the proportion of 3 per cent. carbonic acid was used in an initial experiment on agar test-tube growths of plague (one day old). The test tubes (four in number) were allowed to remain in this atmosphere in the dark at the ordinary temperature of the laboratory (82–88° F.) for two to six days. As a result of this treatment the growths were found to be much more luxuriant than growths obtained in control tubes kept under the ordinary atmospheric conditions in a cupboard. Under the microscope the individual bacteria were large and showed a clear outline with prominent bipolar arrangement of their protoplasm. The chain formation characteristic of the underground growths was evidenced by short chains of several bacteria. Owing to the occurrence of vacuolation in many of the chains, the appearance of striation sometimes so well seen in the diphtheria bacillus was observable.

In the next experiment the fact of there being (probably) a larger amount of carbonic acid than 3 per cent. in the air in the superficial soil of native houses was considered. The abundance of organic matter, the comparatively high ground temperature, the presence of moisture, and absence of ventilation, would probably make the per-centage of carbonic acid present approach the maximum limit of carbonic acid found in ground air, namely, 14 per cent. Three test-tube growths of plague on agar, one day old, were accordingly exposed to an admixture of moist air and carbonic acid con-

* Readings of a Thermometer the Bulb of which was 9 inches below the Surface of the Ground. Government Observatory, Bombay.

January.		January.		January.	
	Fahr.		Fahr.		Fahr.
	°		°		°
3	76·8	13	76·5	22	78·1
4	76	14	76·4	23	77·8
5	76·8	15	76·4	24	77·4
6	76·9	16	76·8	25	77·2
7	75·3	17	77·0	26	76·8
8	75·8	18	77·0	27	76·7
9	76·1	19	77·2	28	76·4
10	76·6	20	77·6	29	76·2
11	76·3	21	77·9	30	77
12	76·6				

taining the latter in the proportion of about 14 per cent. The growths exposed to this condition of atmosphere at a temperature of 92° F. for three to nine days were found to thrive particularly well.

In an experiment in which a cent. per cent. admixture of air and carbonic acid was used at the laboratory temperature the growths appeared to do no better than in ordinary air. In an atmosphere of almost pure carbonic acid the cultures appeared to be inhibited in their growth, but otherwise not seriously interfered with. Stained specimens examined microscopically showed a number of involution forms.

From the above, it would appear that an admixture of 14 per cent. of carbonic acid and 86 per cent. of ordinary air at 92° F. favours and enhances the growth and reproduction of the plague micro-organism.

As has been already mentioned, the advantage of the presence of carbonic acid seems to exist in the fact that it acts as a diluent of the oxygen, and not for any special favouring influence it might have on the plague bacillus. When nitrogen was used instead of carbonic acid, so that 100 volumes of air, instead of containing 79 volumes of nitrogen, were made to contain 85 volumes, a very similar increase of development was noticeable. In this case, however, the microscope did not show the excellent specimens obtained with carbonic acid. Air containing a proportion of nitrogen equal to 90 per cent. did not appear to help the vegetation of the micro-organism.

With hydrogen gas in 25 and 50 per cent. admixture with air the growths did not appear to be specially benefitted. Under the microscope large numbers of involution forms were obtained from an agar culture (two days old) that had been subjected for four days to an atmosphere containing 50 per cent. hydrogen. In a series of agar test-tube growths of plague (two days old) the cultures were found to produce involution forms in abundance and rapidity as the amount of hydrogen was increased. When hydrogen gas was made to pass through nutrient broth containing a four days' growth of the plague bacillus the growth was not sterilized, but large and exaggerated involution forms were obtained in 24 hours with an abundance and similarity of shape to those obtained from a culture of the plague bacillus in sterile tap water at the end of 44 days' growth at ordinary temperature.

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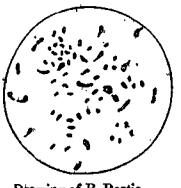
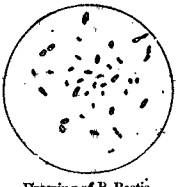
This circumstance would indicate that the conservation of the plague micro-organisms in a living condition is favoured by the production of involution forms.

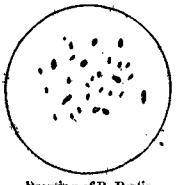
The shapes of the involution forms appeared to be correlated with the nature—whether solid or liquid—of the medium in which they happened to be present. On solid media the tolerably fixed dimensions and shape of the normal bacilli were confused among the involution forms. They had no certain standard of size, or consistent shape: the usual shapes had a bulbous and a tenuous end, with the protoplasm massed on one side. In broth and sterile water the involution forms appeared to be able to retain the shape commonly characteristic of the normal organism. They were usually spherical or swollen-up masses of protoplasm several times the size of the normal form. It was possible to cultivate the involution forms obtained from the agar hydrogen-treated tubes during three generations of sub-cultures.



Drawing of B. Pestis (showing involution forms) from an agar H-treated culture.



Drawing of B. Pestis (involution forms) from a broth hydrogen gas treated culture.



Drawing of B. Pestis (showing involution forms) from a sterile tap water culture 44 days old.

The use of an atmosphere diluted as regards its oxygen by the use of 10 to 15 per cent. of carbonic acid was found to be specially serviceable in occasioning the vegetation on agar of plague micro-organisms existing in small numbers in the blood or tissues of animals dead of plague. It was found that when the infected blood or tissue pulp were inoculated on to agar vigorous growths of the plague micro-organisms were invariably obtained within 24 hours when carbonic acid was used, whereas tubes not so treated, but exposed to the ordinary air in an incubator, either did not develop the characteristic agar growths of plague at all, or did so very slowly.

It was also found that the dilution of the oxygen by the use of 10 to 15 per cent. carbonic acid was helpful in retaining the virulence of cultures of the plague micro-organisms growing in artificial media. Cultures which had made several passages through rats, and experienced growth on artificial nutrient media, such as agar and broth, in the intervals of their existence outside the bodies of the experimental animals, were occasionally found to have lost their virulence, whereas similar cultures placed in an atmosphere containing a diminished amount of oxygen did not lose in virulence.

18,894. Have you any other experiments you wish to put before us?—No? I have made other experiments, but the results are still under investigation.

18,895. You have some clinical memoranda of two cases admitted to hospital at Poona with bubonic plague eight and nine months respectively after inoculation with Dr. Haffkine's prophylactic?—Yes.

18,896. What is the general result of your observations in the first case, the one admitted on the 5th January 1898?—There is nothing special about it except that the man had been in frequent contact with plague for several months. In fact both cases had been in close association with plague and plague-infected spots for some considerable time before becoming infected. I wished to draw attention to their succumbing to the infection only late after inoculation.

18,897. Eight and nine months after inoculation?—Yes. They were ordinary cases of bubonic plague, there was nothing special about them. They both recovered.

18,898. There is nothing more you wish to especially call attention to?—No.

18,899. Do you think they ran a milder course?—Perhaps one of them did, but there were many equally mild cases of plague among uninoculated cases.

18,900. Who inoculated them?—I could get no precise information about that, except that one of the district officers in Bombay had inoculated them.

18,901. How did you know they were inoculated?—I saw their certificates of inoculation.

18,902. Had they been inoculated once or twice?—One twice and the other once.

18,903. Do you know whether either of them reacted to the inoculation?—Yes, one was ill for two days and the other felt ill for 24 hours after the two occasions on which he was inoculated.

18,904. You have had some clinical experience of plague?—Yes.

18,905. Do you ever find high rises and falls in the temperature of plague?—Yes, regularly on the fourth or fifth day; any pyrexia later on in the illness was usually due to the fever of suppuration.

18,906. You have also some records of bacteriological examination for diagnostic purposes of the circulating blood or material from a painful gland in 25 of the patients admitted to the observation wards of the Poona Plague Hospital?—Yes. Of 1,593 cases admitted for observation to the Poona Plague Hospital, 650, or 41 per cent., were diagnosed as cases of plague without much difficulty. The 25 cases under remark were

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doubtful cases. Where there was no doubt the case was either sent into the hospital as plague or kept in the observation camp till better of the condition that simulated plague. Of the 25 doubtful cases examined bacteriologically four were in the second day of illness, 15 in the third day of illness, 3 in the fourth day, 2 in the fifth, and one in the sixth day.

18,907. Had they any other symptoms besides?—Yes. Some of them had symptoms of malarial fever, and that helped to make them doubtful. Examination of the circulating blood in the 25 cases by smear inoculations on agar culture media gave positive results in only three cases (all fatal), a proportion equal to 12 per cent. The examination of glandular material in 18 of the cases ——

18,908. What do you mean by glandular material; did you put a needle into the gland?—I put a needle in some cases, in others a very thin glass pipette, into the gland, and got some lymph and blood from the gland. An examination of this material in 18 cases presenting some glandular symptoms or condition such as hardness, tenderness, or slight enlargement, gave positive results in 14 cases, a proportion equal to 79 per cent. Thus the 25 cases yielded positive results to bacteriological examination in 17 cases, a proportion equal to 68 per cent.

18,909. Did the clinical symptoms afterwards bear out your bacteriological diagnosis?—There were only one or two cases in which doubt continued to exist.

18,910. As a rule have you got typical plague afterwards?—As a rule they were found to have plague.

18,911. You got other symptoms showing they had plague?—Yes; these examinations were made a few hours after admission, and the clinical evidence later on showed they had plague.

18,912. Even the cases in which the bacteriological examination gave a negative result turned out to be plague?—I found that several (two or three) of them turned out to be plague.

18,913. Have you any facts with regard to the presence of plague bacilli in the blood of patients who ultimately recovered?—I enclose two clinical charts* giving short record and character of fever in two cases of plague septicæmia, in which the organism was cultivated from the blood on the fifth and sixth days of the disease respectively. The patients recovered. Of 18 cases of plague septicæmia in which the organism was recovered from the blood, only two (the present cases) ultimately recovered.

18,914. (*Mr. Cumine.*) Have you any reason to believe that the floor of which you took scrapings had already infected some human being with plague?—I cannot say definitely that it had. It was, however, in a plague-infected house.

18,915. (*The President.*) Did you examine any food substances?—No.

18,916. Did you examine milk?—No.

* *See* Appendix No. LVI. (i.) and (ii.) in this Volume.

(Witness withdrew.)

Mr. E. F. Allum.

Mr. E. F. ALLUM, called and examined.

18,917. (*The President*). What is your occupation?—I am a merchant of Bombay. I have been doing plague work in Bandra.

18,918. (*Mr. Hewett.*) You are a member of the Bandra Municipality and Chairman of the Sanitary Committee?—Yes.

18,919. Were you employed in the first plague epidemic in Bandra?—No, I commenced in December 1897, and have continued since.

18,920. How did the place get infected the second time?—It broke out in the village of Khari at the end of December 1897. There were two cases imported from Santa Cruz, which is about two miles from Khari, on the north side.

18,921. Did it get into Bandra from the village of Khari?—Khari was the first village attacked in the whole district of Bandra. There are about half a dozen villages—in addition to the town of Bandra—in the district.

18,922. How did the town of Bandra itself become infected?—The first case in Bandra was in February; I think that was a compositor in Bombay who was living in Bandra. A large portion of the population of Bandra go to Bombay for their occupation.

18,923. During this time there was no interference with their moving between Bombay and Bandra?—No.

18,924. How many cases occurred in the second epidemic at Bandra?—The number of cases for the whole year was 358 attacks and 322 deaths. That is from December 1897 to November 1898.

18,925. Were the majority of these cases in Bandra itself or in the villages?—The majority were in Bandra itself, and occurred mostly in July and August.

18,926. You have never been able to stamp plague out entirely in the town of Bandra?—In November we came down to two cases for the month; in December there was a recrudescence, and this year it is worse than ever.

18,927. Is it bad at present?—In this last December there were 17 attacks and 12 deaths. For the previous December there were only 2 deaths. In January this year there were 56 deaths from plague, and in January last year only 9 deaths. From the 1st to the 15th February this year there were 34 deaths from plague; in February last year there were only 17 deaths for the whole month.

18,928. During the second epidemic in Bandra itself, did you take the people to hospital and isolate the contacts?—In Bandra we had a case in February, and there were isolated or sporadic cases till July; then there was an epidemic at the south end of the town.

18,929. Did you turn the people out of any portion of the town?—When the epidemic came to Bandra it was worst in July and August and that was in the middle of the rains so we could do nothing. In addition to that, it was principally in the Muhammadan quarter of the city, and one could do little with these people. We got some of the Hindus to go out, but we could do little with the Muhammadans.

18,930. Is that still the case?—There is the greatest difficulty in getting the Bandra people out of their houses.

18,931. Is there a difficulty in ascertaining cases in Bandra?—Yes, there is a great deal of concealment.

18,932. How do you endeavour to ascertain the cases?—We have inspectors going round, we have no house-to-house visitation, simply Sanitary Inspectors going around.

18,933. Did you find most cases while the patient was still alive or after death?—We generally get intimation just before the patient is dying.

18,934. In such cases, do you find that some of the contacts have disappeared, or are they generally all present?—Sometimes they are there, and sometimes they are not. It is difficult to trace them in a large place like Bandra, it is easier to trace the people in the villages.

18,935. I believe you treated some of the infected villages in the neighbourhood of Bandra in one way and some in another, please specify the different methods of treatment and the results?—In Khari, in the outbreak of the epidemic, all the people were moved out from the village into huts outside, and we insisted upon all patients being removed to hospital immediately on detection.

18,936. What is the population of Khari?—Roughly speaking from 800 to 1,000. About 12 cases had occurred before the people camped out. All cases immediately on detection were removed to the hospital. Some member of the family was allowed to go with the patient, and the rest were isolated in our segregation camp for six or seven days.

18,937. How long did it take to stop the plague in this village?—It died out about the end of February—about two months.

18,938. Did you have any cases among the segregated people?—Not one, but I should like to add that we were very strict as far as that village was concerned. We burnt all the old clothing, and gave the people

new clothing and blankets, and also fed them for the six or seven days.

18,939. Were the persons who were segregated as contacts permitted to communicate with other infected areas in the pursuit of their ordinary avocations?—No.

18,940. In the village of Pali you adopted a different method, I believe?—Yes; there we had a different class of population to deal with.

18,941. What is the population there?—In Khari the population is mostly very poor, and consequently we could recompense them with money for their loss of labour; but in Pali the people are of a better class, and it was difficult to deal with them in a similar way. I think the population of Pali is about 600. There the people made a temporary hospital in the fields, and removed their sick to it, and all the people camped out of their own accord.

18,942. Did the people look after their own sick?—Yes.

18,943. How were the persons in segregation treated?—There was no segregation.

18,944. How long did it take for the disease to die out in this village?—I should think about six weeks.

18,945. Was there the same opportunity for communicating with infected places as at Khari?—Just the same.

18,946. Was the course of the disease the same?—Yes: it lasted about six weeks.

18,947. Have you any other village you would like to refer to? Danda, for instance?—In July we removed the people out of Danda, which is a village of from 3,500 to 4,000 people. About 1,500 came into Bandra. We took a census and kept them under surveillance, and within the next 10 days some of the people removed were attacked, but no cases occurred among the Bandra people in the neighbourhood.

18,948. Did you at any time during the epidemic at Danda have the contacts segregated for a certain time?—No. It was only in the village of Khari that we insisted upon segregation.

18,949. Is your experience that when you segregate contacts, but fail to keep a check upon the remainder of the population, that you put down the disease more rapidly than if you leave the contacts alone?—I do not think the disease is put down more rapidly, and I should not recommend the segregation of contacts.

18,950. Did you notice any mortality among rats before plague cases occurred in these villages?—Personally, no, but I had reports of it.

18,951. Did those reports satisfy you that mortality among rats occurred before there were any imported cases of plague?—Yes.

18,952. Do you feel sure of that?—Perfectly certain. During this present outbreak this year I have been taking particular notice of it. The village of Pali in this present month of February is an example.

18,953. Do you think that, prior to the mortality among rats in Pali, it was impossible for a plague infected person to have come from any outside area into that village?—No; it was quite possible.

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18,954. So that there may have been a person suffering in that village before the rats began to die?—They were mixing in the whole neighbourhood.

18,955. I mean that you cannot exclude the possibility of rats having been infected by some outside human being?—That is so.

18,956. Did you find that people were as disinclined to give you information in the villages, as they were in the town of Bandra?—The people in the villages are more amenable. The smaller the village, the easier it is to get information, and the larger the more difficult; there is a general disinclination to give information.

18,957. In the villages you could get much more accurate information than in the town?—We find out cases in the villages more easily, but there is a general inclination to conceal cases.

18,958. Did they generally object to European treatment?—Yes; very few take this treatment. They are generally treated in the hospital by the native hakims.

18,959. Did you resort to disinfection in the villages?—Yes; in the village of Khari particularly.

18,960. What disinfectant was used?—We used perchloride of mercury for the interior of the houses, and carbolic acid for the narrow galis outside.

18,961. Did you observe that after a house had been disinfected, the people did not get plague in it, unless they had had opportunities for contracting it outside?—The people moved out of all the houses which were disinfected, and the houses were left vacant for several months afterwards.

18,962. Upon reoccupation, did cases of plague occur in any house which had been disinfected?—In Khari there were cases of plague last month in houses which were disinfected a year ago, and similarly in Bandra.

18,963. Might those cases have been due to outside disinfection?—Yes, it is quite possible.

18,964. You have nothing to show that the disinfection was inefficient?—No.

18,965. (*Dr. Ruffer.*) Do you know of any villages in which there has been an epidemic of plague among rats and not among human beings?—Yes.

18,966. Will you give us the names of those villages?—There is only one village where rats were reported to have died, and that is the village of Sherli. There was plague in the villages on each side, but Sherli escaped altogether.

18,967. How far off were the neighbouring villages?—Perhaps a quarter to half a mile apart.

18,968. At Kantwadi, Malla, and Rajan, you had very few deaths, I think?—Only five deaths.

18,969. There was a noticeable mortality among rats?—I do not know that the mortality was large. It is very difficult to get statistics about the numbers of rats. We get intimation that rates are dying and that is all.

(Witness withdrew.)

Mr. R. J. C. LORD, I.C.S., called and examined.

Mr. R. J. C. Lord, I.C.S.

18,970. (*The President.*) You were Assistant Judge at Broach?—Yes, and am now acting as Registrar of the High Court, Bombay.

18,971. (*Mr. Cumine.*) Where has your experience of plague been?—I saw a certain amount in Ahmednagar as Assistant Judge, and afterwards as Assistant Collector in charge of the Nagar taluka, and as Personal Assistant to the Collector I saw the reports concerning the whole of the district and had an opportunity of noticing their contents.

18,972. Is Nagar city a walled town?—Yes; it is a walled city which used to be the capital of the Nizám Shahi dynasty.

18,973. What is the population?—Over 40,000.

18,974. Are the people crowded together?—Very crowded. The houses are closely jammed together. In one corner of the town you can see about an acre of flat mud roof with tiny openings in it. The tops of the houses are like a table, as it were, with large holes here and there, which are the only means of getting light and air.

18,975. While the people were in the town you had an establishment with a supervisor for every 100 houses in each ward and a certain number of Superintendents to look after the supervisors?—Yes; there were 12 wards.

18,976. And you had a Hospital Assistant to diagnose plague cases?—Yes; we had one, or at one time, I think, two.

18,977. Did this system enable the supervisors to become perfectly well acquainted with all the dwellers in their sections in a short time?—Yes, and thereby search parties were obviated.

18,978. Do you think it is a good thing that search parties should be unnecessary?—I consider search parties do a lot more harm than good, and should be avoided if the other system can be introduced, because a sick woman does not like to be looked at, even though she has not got plague. Nothing is gained by search parties which can outweigh the discomfort and disquiet they cause to the inhabitants.

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18,979. After the occurrence of a certain number of indigenous cases in a ward, I think you evacuated that particular ward, did you not?—Yes, we turned them out by the agency of the police.

18,980. The result was that, by a certain time, the town was completely emptied?—Yes, fairly quickly.

18,981. I understand the people who went out of this town to live, and who were not taken to actual contact camps, lived in two kinds of camps, the Savedi health camp and another one?—Yes. The Savedi health camp was erected by the Municipality, and the other camp was made by the people themselves in the adjoining fields. It is hardly fair to call it a camp, because it just consisted of little huts dotted about in the people's own fields, especially where there was a tree, or well, or something like that.

18,982. Did you have any inspection of these people living in their own huts?—Yes, by the agency of the Abkari police.

18,983. Did you find many cases occurring among them?—Latterly I think there were a good many.

18,984. What did you do when several cases occurred?—We evacuated the field, and segregated everybody in the segregation ward of the Savedi camp. That was the first step in the way of segregation which was taken in the operations.

18,985. Did the infection appear to be brought from the town, or to spread from one hut to another in the fields?—I think it must have spread from one hut to another in the fields after having originally come from the town, because we found that one case in a mala or field was followed by several others. It was not as if the cases were sporadic, but one case nearly always brought on more in the same locality.

18,986. How did you manage with regard to weavers and other handicraftsmen who had to earn their bread?—If they would live in the Savedi camp, we allowed them to have a pass to take them by day into the city, returning at night. Thus we were able to inspect them every morning and evening.

18,987. Did you find that any of them caught plague by going into the town in this way?—Only one, as far as I can remember; that was a weaver who was taken sick at his loom. He died at once, and was buried by his sons in his back yard. He was missed that night, but owing to the ingenuity with which his grave was concealed, it was not detected for, I think, a whole day, though the house and vicinity were searched for it.

18,988. Did the cases appear to get milder towards the end of the epidemic?—No, they appeared to be of a more virulent type. That is simply my impression; it struck me that, as a rule, towards the end of the epidemic, when a man got ill of plague he died within a few hours.

18,989. Did you see any cases of black plague?—One or two were reported to me, but I did not see any myself. I believe that information regarding them can be found upon the record. There were returns of a case which occurred, I think, in Nagardeola.

18,990. Did any cases come to your notice where cats appeared to be attacked with plague?—Nagar was overrun with cats, and in the opinion of the Civil Surgeon there they did get plague. They were looking very miserable, with generally a pink line about their neck. Some were seen by the Civil Surgeon, I believe, in one particular quarter of the town running about with open buboes in their necks, and they were destroyed.

18,991. Do you know whether they were bacteriologically examined or not?—No, they were not, as far as I can remember. The great thing was to kill them and get them out of the way, to prevent the re-infection by them of the houses we had just disinfected. We did not go any further into the matter. The Civil Surgeon may know more about it, but I do not.

18,992. Were there many rats in Nagar?—Very few, perhaps on account of the number of cats.

18,993. Did the plague appear to take any particular course through the town of Nagar?—From east to west, practically, along the three main roads. It seemed to go by a line and then diverge and then pass out through the different gates. It passed in a very regular line, but I dare say that was owing to the fact that evacuation followed that line; but we did not find that the few people whose removal would have endangered their lives who were still allowed to remain got plague behind the line of march.

18,994. I suppose you treated the villages in much the same way as the town?—Yes, practically.

18,995. With all these people going out of Nagar town, did the people in the villages appreciate the danger of admitting refugees who might possibly be infected?—At first they did not; afterwards they did.

18,996. Did you find that although people might be averse to going out in the first instance, still when they had lived a little time in their huts they were perfectly willing to stay there?—Yes, they settled down to it more or less. Of course they preferred to live in the city. Until the middle of February they used to complain of the cold, and then in the third week of February they complained of the heat: it was only really that they preferred their houses; but afterwards, when it came to the time for closing the Savedi camp, there was a considerable difficulty in getting some of the people out of it.

18,997. Did you have many cases in the Nagar district of plague imported from Bombay not taking root in the Nagar district?—According to my recollection there were a great many such cases. So far as I can remember, I think there was only one case at Sathral, in the Sangamner taluka, from Bombay, which was followed by indigenous cases, but I am not certain if even it came from Bombay. Others may have occurred before my connection with plague operations, but I do not think they did.

18,998. Did you find that cases of infection imported from Poona seemed to take root more easily than imported cases from Bombay?—Very much more easily; in fact, I believe it will be found that every case imported from Poona or Sirur led to an outbreak.

18,999. Where did the infection come from to Nagar town itself?—It came from Nagar Cantonment, to which it came from Sirur. Sirur was between Poona and Nagar.

19,000. Where did the infection in the villages come from?—It mostly came from Poona, especially in the Parner and Shrigonda talukas, and to the best of my recollection a certain amount came from Igatpuri.

19,001. How was the infection taken from one village to another?—By sick people.

19,002. By human agency?—Yes.

19,003. How did it appear to be carried from one house to another within a town?—I suppose by human agency, but I must say that as far as I could see in big blocks of houses it did not pass from one house to other houses adjoining it in other streets (*e.g.*, touching back to back, with doors in different streets), but travelled up the street, *i.e.*, it probably was brought through the doors and not the walls.

19,004. (*Prof. Wright.*) Did it surprise you to find every case from Poona affecting the village?—That is more or less a generalization on looking back; I mean it did not strike me at first, and it was only latterly that I came to think about the matter. It did not attract my attention at the time.

19,005. Can you suggest any explanation of the fact?—No. My private opinion is that the bacillus from below the ghats had got to be acclimatized in a damp place, because Poona is a damp place, and so is Igatpuri, more or less, and then Sirur was a little drier, and so the infection was brought gradually to a place in a condition in which it could live. I believe the same thing has been noticed in the Broach district, because cases taken straight from Bombay to Broach did not seem to spread. But when cases were brought into Broach from Ankleshwar, which is just south of Broach, the plague spread at once. I believe there had been several imported cases from Bombay direct into Broach which did not spread.

19,006. (*Dr. Buffer.*) How long does it take to go from Bombay to Broach?—Just one night.

19,007. How long to Ankleshwar?—Pretty much the same time. Ankleshwar is about 6 miles from Broach.

19,008. How long does it take to go from Ahmednagar to Bombay?—About half a day.

19,009. How long does it take to Poona?—A quarter of a day.

19,010. (*The President.*) Do you know what is meant by the "black plague?"—No. We called it "black plague" because the people used to turn black.

19,011. After death or before death?—They were black after death; I do not know when the exact change took place.

(Witness withdrew.)

The Hon. Mr. BHALCHANDRA KRISHNA, called and examined.

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19,012. (*The President.*) You a Licentiate in Medicine of the Bombay University?—Yes.

19,013. And a practitioner here?—Yes.

19,014. You take much interest in the affairs of the Municipality?—Yes; I am President of the Corporation.

19,015. And a member of His Excellency the Governor's Council?—Yes.

19,016. What is your opinion as to the origin of plague in Bombay?—I believe that the theory that it was introduced by fakirs from Garhwal and Kumaun is not tenable. The theory advanced was that some mendicants came from that place and brought with them the poison of plague. I am not prepared to accept that theory.

19,017. Why not?—Because these people came all the way from the north, and they must have halted at different places. They must have gone to Nasik, where there was an annual fair where thousands of people had assembled. If they went there, they were sure to have given the poison to those people, because they were in contact with them. Nasik was not first infected; in fact, it was during the second epidemic in Bombay that some cases occurred in the Nasik district. If the theory be correct, then Nasik and the places where those pilgrims halted should have had the plague to commence with, whereas we find that it commenced in a certain portion of Bombay called the Port Trust Estate.

19,018. How long does a person take to go from Garhwal to Nasik, as a rule?—At least 8 days.

19,019. What view do you entertain as to the origin of plague in this city?—Another theory has been advanced that the plague bacillus was generated *de novo* in Bombay on account of the insanitary condition of those places where it first originated. My own view is that it must have been introduced into Bombay from Hong Kong—first on the Port Trust Estate. My reasons for holding that as a working hypothesis—I will not call it a theory—is this. If we trace the earliest cases of plague in Bombay, we find that about the 15th August cases began to appear; at least, they were noticed at that time, although they were not diagnosed as cases of plague, but as a peculiar kind of fever. The medical men who attended those cases were not in a position to exactly diagnose them. I am informed that the first case occurred in a house situated in Broach Street, in the Port Trust Estate, belonging to Mr. Rowjee Heerji. That is about the 15th August 1896. After that, very close to it, a case was noticed by a medical practitioner on the 21st August 1896. Near the house of Mr. Rowjee Heerji there is a godown belonging to Mr. Dhomo Narsi, situated in Surat Street, on the Port Trust Estate. Close to this house there is a godown of grain, and this godown abounds in rats. I believe that the first infection was communicated from those houses to the rats which abound in this grain godown, and from thence it spread. Even up to this time it is quite circumscribed and confined to one side of the Port Trust Estate. From thence it spread to the other side of the Mandvi Bridge, what is called the Argyle Road and Clive Road, where there is a large mala, called Vakhatna Mala, situated on Clive Road. Then it spread to a house belonging to Mr. Lakhamsi Napu. It is here that Dr. Viegas, who first diagnosed it as plague, found his first case, and he announced it at a meeting of the Standing Committee, of which I was the Chairman, on the 21st September 1896. The history of this case seems to be that Mr. Lakhamsi Napu had some labourers connected with his firm, and they were residing at a place called Marwadis' Mala, where the second case occurred on the 21st August. Two labourers from this Marwadis' Mala used to be associated with the nephew of Mr. Lakhamsi Napu, and all of them died of plague. My argument is this, that all this portion of the Port Trust Estate has godowns, where Chinese goods are stored. There are three on Argyle Road, where Chinese crackers are stored, and there are two or three on Broach Street and Surat Street, where Chinese sugar and Chinese silk are stored. Chinese crackers are generally brought to Bombay in the early part of July, or the beginning of August, and I believe that the infection must have been imported into Bombay by these goods. Crackers are used in August, and then again in November. For nearly a month plague was confined to these Estates only. It did not make its progress beyond Mandvi Bridge towards the city. It was after a month that it entered the city, and then it spread to all its parts. From these facts, I am inclined to believe that it was imported into Bombay from China.

19,020. What is your opinion as to the way in which the disease is communicated?—I believe it is communicated in several ways. The first and most important is by infected and dead rats. I have known of cases where dead rats have communicated the disease.

19,021. Can you give us an example of these?—During the first epidemic in 1896 I saw four cases where the people had handled dead rats; they developed plague and died.

19,022. How soon after handling the rats did they acquire the disease?—Three or four days.

19,023. Had these persons any opportunity of obtaining the infection elsewhere?—So far as I could ascertain, there had not been any other source of infection. Then another case occurred lately in a Parsee lady, near Girgaum. She was taking out rice for cooking, and a dead rat came on to the palm of her hand, and next day she got plague. She was under my treatment, and she died in three days.

19,024. Was there any injury on her hand?—I could not trace any.

19,025. How do you think she acquired the disease—by mere contact?—Yes.

19,026. Through the epidermis?—I believe so.

19,027. Through the uninjured epidermis?—I believe so, because there was no wound on the hand, so far as I could see.

19,028. Besides communication through rats, what other means do you consider may be operative?—I consider the locality is the most powerful source of infection, where dead rats were found. Even if the rats are removed that locality retains the poison, and that is a fruitful source of the disease. Then infected clothing is also a fruitful source. I have seen one or two cases of this, especially one very marked case. It was the case of a young man who, simply through hardihood, slept in the bedclothes where a patient had lain. One case was removed from the bungalow of the Honourable Justice Ranade. The boy was removed to the Hindu Fever Hospital, with which I am connected, and the boy who brought him to the hospital slept in his bed clothes. The result was that three days afterwards he had a very violent attack of plague, and he died on the third day, whereas the boy who was removed previously recovered.

19,029. Had not the boy who died any opportunity of coming into contact with the plague patient who had been removed, before he slept in these bed clothes?—He brought that first boy to the hospital, and there were others with him who were not affected.

19,030. I mean before this boy was taken to the hospital?—They were living in the same house. I made a note of this, because there were others who came with him who all escaped. They lived in the same house, under the same conditions, and they escaped; whereas this boy, in order to try the experiment, slept in the bed clothes one night, and on the third day he got attacked.

19,031. In addition to that, what other means of conveyance are there?—Contact with plague patients.

19,032. Do you think that this contact can introduce plague into the body through an unbroken skin?—Have you any observations which bear upon that point?—I cannot distinctly say that, because it is a very disputed point; in fact, I think I have come in contact with plague cases several times myself, both in private practice and in the Hindu Fever Hospital. Although they are few, at the same time cases have occurred of medical men and ward-boys who were in contact with plague patients who have died of the disease. The medical man in charge of the Hindu Fever Hospital, after three months, all of a sudden, developed plague. So far as I could see, there was no injury to his hand or to his body, and there was nothing to account for it.

19,033. Did you search specially for any abrasions?—Yes; he was under my treatment.

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19,034. You looked at the skin carefully with that object?—Yes, and so far as I could discover, there was nothing.

19,035. What kind of plague was it?—Ordinary pneumonic plague.

19,036. Further than that, do you think discharges from the patients might cause plague?—Yes; discharges from patients, especially patients affected with pneumonic plague, and their sputum. I have noticed cases occurring from the contact of discharges from the body of a plague patient after death.

19,037. What discharges?—Fæcal discharges, or urine, which, falling upon the corpse bearers, gave them plague. Amongst us, the corpse is borne on the shoulders of men; it is not carried in hearses, and so on, but the people carry the dead bodies. Some four cases came to my notice, where the discharge fell from the dead body upon the bearers, and gave them plague. Other cases must have occurred, but I only allude to those cases which I have seen.

19,038. Have you particulars of those cases?—One is a gentleman named Munshi. During the first epidemic in 1896, he assisted in carrying a dead body, and about four days afterwards he developed plague and died.

19,039. What is the evidence that any discharge fell upon him? How do you know that he came in contact with anything proceeding from the corpse?—There is no particular evidence to show that. I was not able to examine the body at the time.

19,040. Now, the second case?—The second case is of Mr. Lokhande, who was similarly infected, but I cannot give any positive evidence that the discharges fell upon his body. These people were not living in an infected place, and they were not living where dead rats were found, and they did not come in contact with any other plague cases except those dead bodies. That much I can say. I am not able to produce direct evidence as to discharge falling from the dead body.

19,041. What is your opinion as to the value of curative serums?—There are three curative serums which have been tried. With regard to Haffkine's curative serum, I think it failed. With regard to Dr. Yersin's, I saw one case which was treated with Yersin's serum and was cured. That was the only case of plague I saw cured by Yersin's serum. In order to give further trial to the serum, I requested Dr. Yersin, together with Dr. Blaney, to go round the Hindu Fever Hospital. He examined all the patients, and said that several patients were already recovering, so that there was no necessity to inject the serum. With regard to three cases which were almost moribund, he said it would not be advisible to waste his serum. But, fortunately, those three moribund cases recovered under hospital treatment, and a note has been made of that by Dr. Lowson in his report*.

19,042. The evidence which came under your observation does not show much?—No.

19,043. You have given a great deal of attention to the value of Haffkine's prophylactic fluid have you not?—Yes.

19,044. I believe you yourself have been inoculated?—Yes.

19,045. Will you describe to the Commission what effects the inoculation produced upon you?—I was inoculated twice, in February and March 1897. On the first occasion I was given 2 c.c., which was injected into my left arm. That was in the evening about 6 o'clock. I was able to attend to my work up to 9 o'clock. After that I had fever which lasted throughout the whole night, and my temperature rose to 101. I was restless all night and had disturbed sleep on account of dreams. I had copious diuresis and severe headache. In the morning I perspired, but I was able to take my bath and attend to my duties, only I felt exhaustion and inability to work.

19,046. When did the temperature go down?—In the morning. I had perspiration in the morning at 6 o'clock and the temperature went down, and I was able to take a bath.

19,047. Now with regard to the local phenomena?—There was swelling of the left arm at the seat of inoculation.

19,048. When?—At the same time that I had the fever, at 9 o'clock, and there was pain. The pain on the first day was not very severe, but on the second day I was not able to move my arm because it was painful. That lasted for three days and left a very thick nodule at the seat of inoculation, but no other symptoms. In fact, after three or four days I felt better than I had felt previous to inoculation. That is say experience of the first inoculation. In March I was inoculated a second time with 2½ c.c. and the symptoms were nearly the same, but on this occasion the temperature rose to 102, and I had disturbed sleep, as I have mentioned. There was no inconvenience of any kind. The sequence of symptoms and the effect on my body were the same as on the first occasion. Then I was inoculated again in February 1899, that is this month.

19,049. A third time?—Yes, about the commencement of February—and I had the same symptoms. I have yet a slight pain left in my arm, but beyond that there is no inconvenience. There is one thing I noticed, and that was a little erysipelatous inflammation running down the lower portion of the arm to the elbow. Beyond that I had nothing to complain of.

19,050. There was no diminution in the severity of the symptoms in the subsequent inoculations?—There was no diminution.

19,051. Is it in conformity with your general experience that the injections have not done much harm?—I have seen several cases, and so far as I have been able to gather it has not done much harm in the majority of cases. I have come across cases where it has produced general malaise, inability to work, or very slight rise of temperature; but beyond that I have not come across any case in which it has produced absolutely serious symptoms. There is one case which I must place before the Commission, and that is the case of a Khoja girl who was shown to me six months after inoculation. She is about 12 years old, and her parents told me that she developed the symptoms a month after inoculation. Those symptoms were the second stage of phthisis. The girl is living now. I treated her and she is all right. I must mention that the family has an hereditary taint of phthisis. Her elder sister died of consumption, but the parents said that this girl developed the symptoms after inoculation. This is a case which occurred in my practice and I must mention it, but I am not prepared to believe that the symptoms were due to inoculation. Very likely if the girl had not been inoculated she would have developed the same symptoms. There is no evidence to show that it was the inoculation which brought on the symptoms. I referred the case to Dr. Haffkine and he also agreed with me.

19,052. Have you been able to follow the after-history of many of the cases which have been inoculated?—Yes.

19,053. Have many of them died to your knowledge?—I have known of one case personally which succumbed after inoculation. It was the case of a Vakil, a strong young man who was living in a house where dead rats were found. It seems that he felt symptoms of fever and plague coming on, and ran up to Bombay to get himself inoculated. On the same day he returned to Thana, and developed very severe plague and died. This is the only case which came to my notice.

19,054. To what do you attribute the plague in this instance?—I attribute it entirely to the previous infection, and not to inoculation. This case has been made much of by the opponents of inoculation, but I know the circumstances thoroughly, and the Commission may take them for what they are worth. The second case is of a Parsee boy, but that was not in my practice. He died after inoculation, but I do not know the circumstances of the case.

19,055. On the other hand have you observed any good effects, outside of the prevention of plague, to follow inoculation?—Yes, I have come across some cases. I mentioned those in a paper which I read in November 1898 before the Grant College Medical Society on M. Haffkine's prophylactic inoculations as follows:—"In certain cases inoculation has undoubtedly produced a beneficial effect on the general health of the inoculated. I have personally seen two cases in whom the anti-plague inoculation produced remarkable results. A medical gentleman, whom many of you know, and who was habitually strong and robust, began, some time back, to lose flesh and strength, and in the course of some months became anæmic and weak. An eminent

* Report on the Epidemic of Plague, from 22nd February to 16th July 1897, by James A. Lowson, Plague Commissioner, Bombay.

physician of our city whom he consulted, pronounced him to be phthisical, but he was not supported by another, also a very competent gentleman of the profession, who declared that he was suffering from an exhausting disease, the nature of which he was not able to diagnose definitely. The patient was treated, but without any beneficial results. While in this condition he was advised to get himself protected against the plague. The result upon his general health was most striking. He began to improve almost immediately after inoculation, and in a few months gained up to 15 lbs. in weight. He dropped all other treatment, and has now completely regained his health and weight. The second case which came within my own observation, is that of the wife of an eminent citizen of Bombay, a Hindu additional member of His Excellency the Governor's Council. She was suffering for a long time from intermittent fever which was not amenable to any treatment. When the rest of the family was inoculated against plague she was inoculated too, at first cautiously, and then with another dose. The two inoculations had the unexpected effect of subduing entirely her habitual fever. Prof. Haffkine has kindly placed at my disposal four other cases of analogous nature. One is the case of Mr. K., residing at Nepean Sea Road, Bombay, who was suffering for a long time from a daily rise of temperature which defied all treatment. Mr. K. desired to undergo inoculation against plague, and requested Dr. Temulji B. Nariman, his medical attendant, to consult Prof. Haffkine. The answer was:—"It is advisable to abstain from inocula-"tion in cases of acute or sudden attacks of fever "the nature and the issue of which is not taken, but "there is no contra-indication in cases of chronic "fevers; only the inoculation should be done in such "cases with reduced doses." Under this advice Mr. K. underwent inoculation by Prof. Haffkine himself, with the result that the inoculation produced the usual rise of temperature, which subsided within 24 hours; but with that Mr. K.'s usual fever was entirely cured. Prof. Haffkine visited the gentleman a fortnight later, found him in perfect health, and inoculated him again with the full standard dose, to which he re-acted as a perfectly normal case. The other cases were those of Captain MacDonald, I.M.S., and his servant, who were suffering from continuous attacks of malarious fever defying all treatment. They were inoculated against plague with the result that their chronic fever left them entirely. Another similar case is that of Dr. K. N. Gokhale, L. M. and S., Chief Medical Officer, Bhor State. Dr. Gokhale, when he first joined his appointment, suffered from fortnightly attacks of fever. When plague broke out in the State he went to Poona and got himself inoculated in the David Sassoon Hospital. From that time he never had another attack of fever." These and other similar cases to a great extent bear out Prof. Haffkine's view that the inoculation against plague seems to influence favourably the resistance to some other diseases than plague, and especially fevers.

19,056. Will you state generally the result?—The result has been beneficial in those cases, although the inoculation was not done with the object of curing them, but simply as a preventive of plague. In the case of the Parsee gentleman whom I have mentioned, he was a medical man himself, suffering from a wasting disease, and the physicians of Bombay were not able to diagnose his case. Some said it was phthisis, and others said it was a wasting disease.

19,057. It was a vague affection?—Yes.

19,058. What were the others?—They were malarious fevers. They have distinctly been benefited. There was the case of a friend of mine, a member of Council also, and his wife. She suffered from malarious fevers and she was inoculated for plague, and the result has been that she has shaken off the fever.

19,059. Have you never found cases of malarial fever recover rather unexpectedly?—They do.

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19,060. Likewise in cases of vague illnesses, such as a wasting disease, sometimes a most unexpected improvement takes place?—That is so. I have said that it may not be due to inoculation.

19,061. Have you had much experience of the effects of the prophylactic in actually preventing plague?—Yes.

19,062. Under your own observation?—Yes.

19,063. Have you the statistics?—I have mentioned them in the pamphlet* which I have put in as an accompaniment to my précis of evidence.

19,064. Have you any collection of cases?—I have collected a few cases.

19,065. Will you put them in and tabulate them?—I have not put them in tabular form, but they are all included in these statistics.

19,066. Individual cases are not likely to be of much value unless they are very definite. Are there any which you would like to state particularly?—I will mention two or three cases. For instance; in the family of a Parsee friend of mine several members were inoculated. He was living at Parel. His servants, some four or five Bhyas, refused to be inoculated, and when plague spread to Parel two of those four Bhyas died. Then the remaining two insisted upon being inoculated, which was done, and they did not get plague. Then in the case of a Muhammadan friend of mine, also a member of the Governor's Council, all the members of his family were inoculated, but some three servants refused to be inoculated. During the first epidemic those three servants succumbed, while all the rest escaped the disease. In another family, in the same way all the members were inoculated except one girl, and that girl died, while the others escaped. These cases I mention for what they may be worth.

19,067. (*Mr. Hewett.*) What were the main types of the disease in the three different epidemics?—Firstly, bubonic plague, then pneumonic plague.

19,068. When was that?—That was in the second epidemic.

19,069. Did this type prevail throughout the second epidemic?—It was in the middle part of the second epidemic.

19,070. Can you give us the months approximately?—I think it was in the months of February and March.

19,071. What is the chief type of the third epidemic?—The third type has been almost pneumonic; it is a mixed type. Sometimes there were not enlarged glands at all, but simply fever and delirious symptoms, but in others only the pneumonic type.

19,072. What is it mainly at present?—At present it is bubonic.

19,073. Is it very fatal now?—Yes, it is.

19,074. Is the bubonic form now more fatal than it was in the first epidemic?—Yes, it is.

19,075. Have you noticed any instances of people catching pneumonic plague from a bubonic patient?—No.

19,076. Have you noticed any cases of people catching bubonic plague from a pneumonic patient?—No.

19,077. (*Dr. Ruffer.*) Do you think a great many of the patients in this epidemic get lung symptoms?—Yes.

19,078. Do you consider that a bad sign in plague?—I do.

19,079. With reference to the case that travelled up from Thana in order to get inoculated, how long afterwards did he get plague?—Six hours afterwards. He was inoculated, and immediately developed plague after going to Thana.

* Not published in the Proceedings of the Commission.

(Witness withdrew.)

Dr. D. A. D'Monte called and examined.

Dr. D. A. D'Monte.

19,080. (*Mr. Cumine.*) You are a non-official, I think?—Yes.

19,081. You are Vice-President and Plague Authority at Bandra?—Yes.

19,082. I think that Bandra has had an epidemic of plague during each of the three last years?—Yes.

19,083. Can you say which of the epidemics was the worst?—The first one was the worst; but the third one is not yet finished.

19,084. I mean with regard to the virulence of the germ?—This one, I think, is more virulent.

19,085. Was the second one milder?—It was mild, I think, compared with the others.

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19,086. In your précis of evidence you mention that the first case during the present epidemic occurred in a hut where the first imported case from Bombay died in 1896?—Yes. This seems to show that the germs remained dormant for a period of 24 months.

19,087. Might not the present infection have been imported from outside by the person attacked? — I do not think so. This was an indigenous case; it occurred in a person who never went to Bombay, and could not have got the infection from elsewhere.

19,088. Had anybody from an infected place come to him?—I do not think so.

19,089. Had there been any cases in this hut in the previous epidemic?—Not in the second epidemic.

19,090. Have you noticed whether, in the succeeding epidemics, the cases seem to occur in the same houses? —Yes.

19,091. Do they occur in those houses only?—They occur in other houses as well; but, generally, in those houses where plague occurred in the first and second epidemics, cases have occurred again this year.

19,092. Are you able to say that the infection was not brought from other houses into these houses in the present epidemics? — In some cases they were not brought from other houses.

19,093. You think it was a resuscitation of the old germs in the house itself?—Yes.

19,094. How are you able to say positively that in certain cases there was no re-infection from other houses?—I could not say positively.

19,095. You mention, in your précis of evidence, two cases of buboes in cats, and also fowls getting plague. How do you know the fowls had the plague? —Because just before some cases occurred in some of the houses in a village, lots of fowls died.

19,096. How do you know that they died of plague? —Because they actually had buboes in the neck and groin.

19,097. Have you any instance where a person has certainly caught plague from clothing?—No.

19,098. Have you any instance where persons caught plague from an article of food?—No.

19,099. Have you any instance where people have caught plague from the corpse of a person who has died of pneumonic plague?—Yes.

19,100. Is it within your knowledge that the people living on the ground floor of houses are more susceptible to the disease than those living in the top floors?—Those living in huts and on the ground floors are more susceptible.

19,101. Is the nature of the floor different in the ground-floor rooms from what it is in the upper rooms?—The top floors are made of wood, and the ground floors are of earth.

19,102. When people live in sheds in the fields, does the plague spread much from hut to hut, or only a little?—Only a little.

19,103. Have you had any experience of inoculation with Prof. Haffkine's prophylactic serum?—Yes.

19,104. How many cases have come under your notice?—About 27.

19,105. Did you observe any bad effects in any cases? — In one case. That was not inoculated by myself, but by Prof. Haffkine himself.

19,106. What was the bad effect? — I did not mean a bad effect of inoculation; but this man was inoculated, and he got a bubo after inoculation, and died.

19,107. Did you see him?—Yes.

19,108. Have you any instance where a man has caught plague three times?—There is one case.

19,109. Did you see the man each time?—Yes.

19,110. What was the interval between the three attacks; could it not have been a relapse? — Three months the first time, and six months the second time.

19,111. (*The President.*) We had better have the exact date of each occurrence? — I have not them here, but I will give them. (Witness intimated later that he was not able to get the exact dates.)

19,112. (*Mr. Cumine.*) How many cases of Haffkine's curative serum have come under your notice?—Four.

19,113. What happened in each case? — They all died.

19,114. How many instances of Yersin's serum?— One, and that patient recovered.

19,115. How many cases of Lustig's serum?—Two, and both recovered.

19,116. (*Prof. Wright.*) Did you examine those fowls which died of plague?—Yes.

19,117. How many *post mortems* did you make? — I did not make any. I saw the fowls myself.

19,118. How did you see they had buboes? — I could feel them.

19,119. How many buboes had each fowl? — Some had one, and some had two.

19,120. They were not examined bacteriologically?— No.

19,121. In the case which you report, in which a man had plague three times, can you tell us whether he had buboes each time?—The first time he had a bubo; the second time he had no bubo; and the third time he had a bubo.

19,122. How was it known that he had plague a second time?—He had a very high temperature, rigors, and drowsiness—the same symptoms, almost.

19,123. Where were the buboes in the first and third times?—In the groin, both times.

19,124. The same groin?—Yes

19,125. Did he recover from the third attack also?— He died of the third attack.

19,126. (*Dr. Ruffer.*) What class of people live in the ground floor, as compared to top floors; are they a better class of people?—No, they are poorer.

19,127. (*The President.*) To what do you attribute the difference; how do you explain the difference in mortality in the ground floors, as distinguished from the higher floors?—To the dampness of the floor.

19,128. Is there any difference in ventilation?—Yes; the top floors are better ventilated.

19,129. The conditions there are, in that respect, similar to those which prevail in the huts in the fields? —Yes.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

FIFTIETH DAY.

Saturday, 18th February, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S., (*President*).
Mr. J. P. HEWETT. Dr. M. A. RUFFER.
Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Dr. C. H. FREEMAN UNDERWOOD called and examined.

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19,130. (*The President.*) You are a doctor of medicine, I think?—Yes, and a licenciate of the King's and Queen's College of Physicians, Ireland.

19,131. Have you any official position in regard to plague?—No. I am in private practice in Bombay.

19,132. (*Dr. Ruffer.*) Can you give us any evidence as to the origin of plague in Bombay?—To the best of my knowledge the plague has been in Bombay in 1690, 1700, and also in 1804–5.

19,133. I mean the present epidemic?—In the epidemic of 1896 my initial cases were observed in the latter part of July or the early part of August 1896. Following on these I managed to obtain three photographs which I took of what appeared to me a peculiar type of disease. Two were natives, and one is an European.

19,134. When were these photographs taken?—These were taken as soon as I saw the cases in the latter part of July, or early days of August 1896. The generality of the cases I observed were rapid in incidence and fatal in termination without glandular developments; the course of the disease being terminated within 24 or 48 hours of its incidence. Following on these I managed to obtain photographs of three peculiar cases, two natives and one European, the former being cases of bilateral parotid enlargement, an intumescence of the thyroid gland and the tissues of the neck, the pharynx and tonsils being deeply injected, and aphonia, *tinnitus aurium*, and occasional flashes of light before the eyes being complained of; the maximum temperature in the Muhammadan case was 104·8, whilst the Hindu showed 105·F; both recovered.

19,135. I want to know first about the cases which terminated fatally in two days. First of all what evidence have you got to show that they were cases of plague?—From the rapid course, and, to say the least, the unique and peculiar clinical features of these cases, I was led to diagnose them as *typhus siderans*. No previous cases had been reported, and as it was very obscure at the time I put these down as *typhus siderans*.

19,136. What evidence have you got to show that these were cases of plague?—The rapid course, the high fever, and the glandular enlargements. My subsequent experience of plague proved beyond doubt that they must have been cases of plague.

19,137. Why?—Because you get, even in the present day, cases that commence with very high fever. The nervous system seems completely to be shattered by the virulence of the poison, and in fact sufficient time does not remain for the development of glandular enlargements.

19,138. But do not you get similar symptoms from other microbes, for instance in septicæmia from post-mortem wounds?—In such cases there is always the history of pre-existing wound infection.

19,139. Did you look for an infection wound?—Yes. It was said here by some medical men that the glandular cases were generally the result of infection.

19,140. I am not speaking of the glandular cases; I am speaking of the other cases?—I have not been able to trace any infection through external wounds or abrasions.

19,141. The only evidence you have got that these cases were plague was the presence of profound intoxication?—Yes, and that they died quickly.

19,142. You made no bacteriological examination of the rapid cases?—No, not of rapid cases. When I saw them coming on I made bacteriological examinations, I made an agar culture, and I then found the plague bacillus.

19,143. What month was that?—It was September 1896, or the latter part of August. The cases were not so numerous.

19,144. You did not make any bacteriological examination of these rapid cases in July or August?—No.

19,145. When was the first case in which you made a bacteriological examination?—I cannot rely on it, but I believe at the latter end of August.

19,146. There you found the plague bacillus?—Yes.

19,147. Did you recognise it at the time?—Yes.

19,148. Did you notify it to the authorities?—Having no voice in the councils of the city, I sought the Health Officer, but on each occasion missed both him and his Assistant, in consequence of their multifarious duties demanding their presence elsewhere, and it was left to Dr. Viegas to bring the matter before the Standing Committee of the Municipal Corporation.

19,149. Have you seen similar cases since?—Very many.

19,150. Now you are able to diagnose them as plague cases?—With certainty.

19,151. Are these acute plague cases which you observe now similar to the cases which you saw in July, or do they differ in any way?—They seem very similar and present the same acute septicæmic intoxication.

19,152. Can you give us an account of the acute symptoms noticed by you in July?—I was called to see these patients when they were suffering from high fever. Many of them were in a comatose condition, some of them with a low muttering delirium: others could be roused when loudly called to, relapsing again into this apathetic, or semi-conscious state; the fever ran high; there were no glands at the time, and there seemed to be no pulmonary, cardiac, or any other complication as far as could be made out. Some of them had bronchitic complications, but nothing much to speak of.

19,153. Did you examine the eyes?—Their eyes were injected.

19,154. What was the tongue like?—Coated and dry.

19,155. You held no *post-mortem* examination?—No, it was impossible, as a private practitioner, to do so.

19,156. Can you tell me where these cases occurred; in a certain district, or scattered through the town?—In a certain district—in Mandvi.

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19,157. At that time, had you already found dead rats at Mandvi?—It was I who first drew attention to the rat mortality.

19,158. When did you first draw attention to the mortality among rats?—In 1896.

19,159. What month?—I believe in the month of September. Previous to that rats died here and there, but in September, when the plague increased in virulence, rats died in very large numbers.

19,160. In all bubonic cases you observed in July or August, in what part of the body were the buboes?—The larger percentage was in the right inguinal.

19,161. The photographs you have shown us are mostly cases of cervical enlargements?—Yes, but those were seen by me also about the early part of the epidemic of 1896.

19,162. When did you observe these cases of enlargements in the neck?—I believe in August, I am not quite sure.

19,163. When did you see the cases with enlargements in the groin?—In the latter part of August and September.

19,164. How are you certain that these cases were plague and not enlargement of the glands from other causes?—From the rapid incidence of the disease, the high temperature and the absence of any syphilitic or other contamination.

19,165. Anything else?—The dirty and filthy condition of the houses that they lived in.

19,166. Did these cases terminate fatally, or did they not?—Not all.

19,167. What was the proportion?—In 1896 I was fairly successful.

19,168. About how many cases did you see in August?—Between 10 and 15.

19,169. How many died?—Most of them died.

19,170. Did you notice any cases of pneumonia at that time?—I did. I was the first who drew attention to that in Bombay.

19,171. In August?—No, in September.

19,172. Did you consider these cases of pneumonia at that time as plague, or as ordinary pneumonia?—I had my suspicion that it was not the ordinary pneumonia on account of the very exaggerated symptoms and the rapid development of hæmorrhagic expectoration.

19,173. In the cases of pneumonia did you find bubonic cases in the same house?—I cannot say that I did.

19,174. Did you ever see several cases of pneumonia occur in the same house at that time?—I have noticed as many as two, not more.

19,175. Were these cases in the worst part of the town?—At Mandvi. There is very little to choose between the worst parts.

19,176. They are all bad?—Yes.

19,177. (*The President.*) Was it in the worst part of Bombay?—Yes, Mandvi is a very bad part. It was built on the former sweepings of the town.

19,178. (*Dr. Ruffer.*) How do you think the disease got into Bombay? Have you any facts bearing on that?—Yes, I believe that the disease has been hanging about Bombay, on and off, for some centuries.

19,179. What facts have you observed to make you think that?—I quote from authorities.

19,180. I do not want quotations, I want facts. Did you ever, before July, 1896, see a case of plague, or a suspicious case of plague?—I could not say that.

19,181. Do you know any medical man who has seen a case of plague, or anything like plague during that time?—I do not think so. There is a medical man in Bombay, who, I believe, saw cases; on my asking him to give his evidence here, he replied that he "did not care to waste his time—his time was too valuable."

19,182. Then you have practically no evidence on that point. Have you any other reasons for thinking that plague was present in Bombay?—Not recently, not within any short period before its development in 1896.

19,183. Say within the last two years before 1896?—I have evidence of it being here in 1804 and 1805, when it ruined the city completely.

19,184. Within the last 10 years?—No, not within the last 10 years.

19,185. Do you think the disease was imported into Bombay?—No, I do not.

19,186. Why do you think that it was not imported?—Because there is a history of it having been about Thana Daman and Bombay before, extending over a period of two centuries.

19,187. I mean within the last 10 years?—Not within the last 10 years. The last I heard of it was in 1836 and 1837, in the Jodhpur State and at Pali.

19,188. Have you any evidence to show that plague was present in Bombay or parts round Bombay between 1836 and 1896?—I have not, but what I would wish to suggest is this: that the microbe has been in the soil.

19,189. Have you any facts to show that the microbe was in the soil?—The rat mortality points to that.

19,190. The rat mortality broke out after you had seen suspicious cases of plague. Have you any other facts to show that the plague bacillus was present in the soil in India between 1836 and 1896?—No, I have not. The rat mortality was coincident with the appearance of plague.

19,191. Can you give us some information as to the course of the disease?—The disease was spread by human agency chiefly. Mandvi is a business centre, and many people from various parts of the town find employment there during the day. It being at that time an infected spot, it is possible that they may carry away the poison in their systems to the other localities of the city, and there, after the period of incubation had been completed, the disease developed itself. It spread first in a westerly, then in a southerly, and lastly in a northerly direction.

19,192. How do you know that?—The spread was slow, and I traced it on to Bhuleshwar and Girgaum, and other parts of the town.

19,193. How do you know that there were not other cases in other parts of the town? All you know is that there were certain cases in that direction, but when you say it spread in one direction you mean that it spread in that direction alone?—We get the mortality tables from Dr. Weir.

19,194. We have had the tables from Dr. Weir. You have no other facts?—No.

19,195. In your précis, you say you think there were "influences, meteorological and telluric, which acted as "determining factors on the disease"?—We had a water-logged soil which was consequent upon the heavy monsoons that we had, and an obstruction at the outfall of the sewage system, which led to a damming up of the whole of the sewers and overflow of the sewers on to the low lying districts of the town. Add to this, the retention in the soil of the balance of 10 million gallons, the daily water supply of the city, and the water-logged condition is accounted for.

19,196. What evidence have you got to show that these conditions would spread plague, or would influence plague in any way?—The soil pollution and dampness would influence the development of the plague bacillus.

19,197. Why?—Because an organically polluted soil is a very favourable medium on which to grow any sort of bacterial entity whatever.

19,198. Have you any other reason to believe that the sewage or damp contaminated soil would spread the plague?—The exhalations from these polluted areas of course would vitiate the atmosphere and be determining influences, especially where the air was bad in stagnated localities—from aërial stagnation.

19,199. You think overcrowding would act in the same way?—Yes.

19,200. Do you think it would act in any other way?—It would lead to a vitiation of air, and the air would be re-breathed. It would have a devitalising influence on the human economy, and render it prone to the inception of any disease whether zymotic, or other.

19,201. Could you give us any evidence as to the pneumonic form spreading plague? Have you noticed that the pneumonic form is more contagious than any other?—I have.

19,202. Could you give us any facts, for instance, instances where there has been several pneumonic

cases in the same house or in the same room?—In the same room, yes; but I have not got the facts.

19,203. You have seen that?—I have seen two cases in the same room develop one after the other, first the son and then the mother was attacked.

19,204. That is one case; can you give us the others?—I cannot isolate them now.

19,205. Have you seen pneumonic or bubonic cases occurring in the same house?—Yes.

19,206. Could you give us examples of that?—In the same room in the same house? I could give you numerous examples. Had I known before, I could have given you the numbers of the houses in Mandvi that have developed and redeveloped plague in each epidemic.

19,207. That is not what I mean. Have you ever seen it in one family; at one and the same time, one person with plague pneumonia, and one or two or more persons with glandular disease? Can you show, for instance, that a person got bubonic plague from a pneumonic patient?—I could not trace the connection.

19,208. Can you trace the connection where a person got pneumonic plague from a bubonic patient?—I cannot.

19,209. Have you any example showing that a bubonic patient got bubonic plague from a bubonic patient?—Yes.

19,210. Can you give us some examples of that?—There is a case down at Abd-ul-Rahman Street. A boy, aged 14, was attacked with bubonic plague. He had four buboes, two on the right side and two on the left, in the groin, out of which the one on the left groin suppurated, and the entire gland was discharged. On account of the acuteness of the inflammation it was thrown out. Subsequent to that the mother got attacked, and then the aunt got attacked.

19,211. How long after the first attack?—I should say about a fortnight or three weeks.

19,212. She might have infected herself from someone else?—She was in attendance on the boy while he was ill. I do not believe she left the house; and in that very house there were eight or ten cases.

19,213. Did the boy die?—No; he is alive now. He had a temperature of 108½°.

19,214. Might she not have infected herself from the eight or ten cases?—They were subsequent to the mother.

19,215. In that house did they all have the bubonic form?—All bubonic; not a single pneumonic case.

19,216. Did any of the cases die?—Yes, several of them.

19,217. (*The President.*) Did this house consist of one or several chambers?—Several chambers.

19,218. (*Dr. Ruffer.*) What do you consider is the most infective form of plague?—The pneumonic.

19,219. Why do you think the pneumonic form is the most contagious?—For the simple reason that I have seen this one particular case occur, and I believe that it was owing to infection hanging over the patient. Then there is the case of Dr. Manser; he got the disease from a pneumonic case.

19,220. In all these cases the pneumonic form always produced another pneumonia case?—Yes, as far as I know.

19,221. The bubonic form must be infectious too?—Yes, but not to the same degree as the pneumonic form.

19,222. Why do you think the bubonic is not infectious? You have only given us two examples?—There is the case of the English nurse in Poona, who was attending a case.

19,223. We have had that case. Have you any others under your own observation?—No, I cannot mention any.

19,224. Do you think rats have much to do with the spread of plague?—I do.

19,225. Could you give us any facts bearing on that?—Rats, being dirty feeders on organic débris of every description, especially in damp localities with organic pollution, where conditions are favourable for the development of the lower grades of organic life, are from their peculiar proclivities prone to bacterial and other infection. In the recognition of a rat mortality as a criterion of an infected or plague area, the fact of their tenacity for life and well-being must not be overlooked, and a sudden exodus to other localities has followed.

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19,226. How do you know that?—I have seen them.

19,227. Have you seen an army of rats walking about from place to place?—People have told me. At one period of the plague there were no rats at Kolaba.

19,228. Who told you?—Mrs. Guidera, who got the plague.

19,229. Did you observe these facts yourself or is it only hearsay evidence?—Some I have observed, and others I have been told by my patients.

19,230. How do you know there were no rats in the place?—She said there were no rats, and she was surprised to see rats in the garden. Subsequently to that dead rats were found in her house and she got plague.

19,231. That does not show that there was an exodus. It simply shows that dead rats were found in the garden. You say they migrate from place to place. What facts have you got to show that?—People themselves have told me. They say the moment plague occurs in a house every rat leaves the place; they were found on the opposite side of the street where they were not before.

19,232. How do you know they are the same rats?—It would be very difficult to say.

19,233. How do you know, for instance, that the rats who lived on the left side of the street went over to the right side of the street?—Generally the sides that are infected are deserted by rats.

19,234. That simply shows that the rats have died?—Not necessarily.

19,235. That is one explanation?—No; they carried the infection from here to Bandra.

19,236. You say that you know rats migrate from the side of the street because people told you on the other side of the street that the rats were there, and none were seen on this side of the street. That does not show that the rats on this side of the street went to the other—at least it does not in my opinion?—It is very difficult to observe each individual rat.

19,237. I quite agree with you. I want to know how you can say there was an exodus of rats, and that the rats migrate from place to place?—Because I have seen them travelling over the causeways. I heard that they were migrating and I went to verify the fact.

19,238. Have you seen them travelling along the streets?—Yes, I have seen them running along the causeways.

19,239. Have not you seen them before the plague occurred?—I cannot say I ever went to see them then.

19,240. Your attention was drawn to it, and then you observed them going across the street. Have you any evidence that more rats travelled across the street during the epidemic than before?—It is impossible for me to know that.

19,241. What other evidence have you got to show that rats migrate from place to place?—They were found in localities in which they did not exist previously.

19,242. How do you know that?—Because people have told me.

19,243. But is it not the fact that when rats are dying of plague they, in a dazed condition, leave their holes, so that more would be seen than in ordinary times?—I was the first that pointed that out. They were in a state of plague intoxication and they did not care where they went; and they did not seem to notice human beings if they came near them or even kicked them.

19,244. Would not that account for the fact of their being seen in places where they never have been seen before? Take Watson's Annexe, for instance? I have never seen a rat there; but supposing rats got plague in Watson's Annexe, I should probably see them, because they would come out of their holes. You, yourself, have observed it. Would not that account for the fact?—They seem to die so rapidly that a few hours finishes them off.

19,245. Does not this simply show that the disease is very contagious? Does the fact of a rat being seen where it never was seen before show that it comes from another place?—Not necessarily.

19,246. Have you any other facts to show that rats migrate from place to place?—I have noticed them, as

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I said, travelling across the causeways during the still hours of the night, when traffic was suspended. They have, in some instances of the occurrence of plague on the lower floors, escaped to the higher ones, and even across the streets to other, and, to them safer, localities.

19,247. I will put it in another way to you. Do rats get on board ship?—They do in the usual course, but since 1896 they have been practically exterminated in the locality of the docks.

19,248. Are not you losing a good many rats now in Mandvi?—Occasionally in the town, but not about the granaries, as formerly.

19,249. There are no rats there?—Very few.

19,250. If rats carried the disease, how do you account for people on board ships not getting the disease? Are not rats continually going from ships ashore, and from the shore on to the ships?—The docks are kept particularly clean, no organic débris lying about, and no filth, of any description.

19,251. What was the causeway where you saw the rats?—The Mahim Causeway and the Sion Causeway.

19,252. Is that near the harbour?—No; on the other side of the city altogether.

19,253. Have you any other facts to show that rats spread the disease?—The disease has invariably occurred where rats have been found dead—within, at least, 60 to 80 per cent. of cases.

19,254. Anything else?—Under favourable conditions I have noticed that the bacillus has steadily increased; and if you keep the rat at a warm temperature, you find that the bacillus increases for the first 24 hours in the body of the rat: afterwards there is no increase.

19,255. It multiplies?—Yes.

19,256. Anything else?—No.

19,257. Can you give us any facts showing that plague is carried by air?—People from different parts of the city have always worked at Mandvi during the greater part of the day, it being an important business centre, and used to have their meals at their homes. They used to be at Mandvi during certain hours of the day, and only those hours. After that they used to go home, and it was not possible that otherwise than through the air they imbibed the disease; because many of them had no wounds, and to all intents and purposes were in perfect health, and perhaps within two or three hours after their return home they developed plague.

19,258. Have you any other facts besides that?—There was the case of the very first European that got plague, Mr. Orford Sherman. He had been photographing the cases at Mandvi, and subsequent to that he developed plague, and died of it.

19,259. How does that show that he got it through air?—He was otherwise perfectly healthy; a man at his business.

19,260. You have no other facts?—No.

19,261. I believe you have done a good deal of inoculation work?—Rather more than 2,000 cases.

19,262. Did you take the temperature of these cases?—Previous to inoculation, yes.

19,263. After inoculation?—I had no opportunity.

19,264. Did you ever see any evil effects from inoculation?—I cannot say that I have seen any evil effects.

19,265. Have you ever seen any abscesses?—Not as a result of my inoculation, but from neglect of due asepsis.

19,266. Have you ever seen very high temperature after inoculation?—Yes; 105°.

19,267. You said just now that you took no temperatures after inoculation?—The patients told me.

19,268. Did they take their temperatures themselves? Yes.

19,269. Have you any other evidence as to the rise of temperature?—The majority of them came round, and told me it was about 102, 103, and so on.

19,270. How did they know?—The Parsees are an educated class.

19,271. You refer specially to the Parsees?—Yes.

19,272. How did you standardise the dose you used?—I judged the dose according to the individual I had to deal with, rejecting those in whom I found an increased temperature.

19,273. You said you took no temperatures?—Previously to inoculation I did.

19,274. Previous to inoculation; but we have been told that one way of standardising the prophylactic fluid is to take the temperature of a certain number of people after the fluid has been injected. I understand you did not do that?—It was not possible.

19,275. How did you judge the dose you were to use? For instance, supposing the Plague Commission came to you to be inoculated, how would you judge what dose you were to give each Commissioner?—It would be the case of the eminent French physician, who judged according to the exigencies of the hour, and the individual susceptibilities of his patient.

19,276. But you could not possibly know the individual susceptibility of the 2,000 persons who came to be inoculated?—It is impossible to judge idiosyncracies.

19,277. Supposing 100 people presented themselves, how would you judge the dose you inoculated into each one of them: did you inject all with the same dose?—No.

12,278. What guided you in the choice of the injection?—First, their individual physical condition.

19,279. What points did you attend to in their physical condition?—Whether they were well nourished, whether they were frail, whether they had recently recovered from illness, whether they were by nature weakly, whether there was any physical tendency; and generally, whether there were any other militating conditions, such as the existence of old disease, scrofula, or anything else.

19,280. Then you reduced or increased the dose according to these conditions?—According to the individual condition of each man.

19,281. You must have started with a standard dose; how did you ascertain this standard dose? Did you simply take what was on the bottle?—I did not. The doses written on the bottles vary, and at that time I took it tentatively. I graduated my doses. I started with the dose marked down as the standard, which was 5 c.c., in all these cases. I did not believe in initial and only inoculation: I believe in a succession of doses rapidly increased from the minimum dose.

19,282. Did you inoculate these people several times?—Yes, twice and three times.

19,283. With gradually increasing doses?—Yes.

19,284. What guided you in the number of times you inoculated the people, why did you inoculate one person once, and another person three times?—I inoculated as many as I could three times.

19,285. At what interval?—At intervals of a week or ten days.

19,286. What dose did you inoculate each time?—According to the individual I had to deal with I would give him two c.c., then three, and afterwards, five.

19,287. Why did you adopt this method in preference to M. Haffkine's method?—I adopted this method thinking of obtaining a gradual, but permanent, immunization; that was my idea.

19,288. But have you any facts to show that you can produce a gradual and permanent immunisation against plague by repeated doses?—I should have said, as perfect an immunization as possible.

19,289. What facts have you got to show that you do get a permanent immunization by this method?—Because "a perfect immunization" is a scientific fraud. In some cases—I will not say all—I found the initial dose produced a re-active fever, in the second inoculation the reaction was less.

19,290. What height of fever?—102 perhaps.

19,291. Is not that the very thing that you want to get?—Yes, for the development of an anti-toxine in the blood.

19,292. We have no evidence as to the development of the anti-toxine. Professor Haffkine told us he wanted a temperature of 102. You got that temperature, and then you inoculated people again. What facts have you got to show that three inoculations are better than one?—Because, as far as I am able to judge from the experience of others, those that were inoculated three times seemed to have a greater resistent power against plague than those who were inoculated only once.

19,293. But who else has inoculated people three times? We have not had it in evidence yet, and I should like to know who the people are who inoculated three times. It is an interesting point. Can you tell me anyone else in Bombay who has inoculated three times?—I believe Professor Haffkine has inoculated twice.

19,294. Yes, but you said three times?—There were so many inoculating in Bombay at the time, that it is difficult for me to get facts.

19,295. How can you know that three inoculations are better than one if you have no facts?—People used to come and get inoculated, and we lost sight of them after that, and there was no time to get complete results.

19,296. Why do you think it is better?—Because instead of one, you get three re-actions.

19,297. What evidence have you got to show that three reactions are better than one?—Out of all these people who were infected, I believe a small percentage of those were inoculated three times were infected within a period of two or three months.

19,298. Can you give us any statistics as to that?—It is impossible for me to give you statistics.

19,299. How many of the 2,000 people did you see again after inoculation?—With regard to the three inoculations, my object in these cases originally was to get, if possible, a view of these people again after they had been inoculated, to bring them back and get the results from them.

19,300. How many of the 2,000 people have you seen since, as a matter of fact?—I have seen numbers; I could not approximately say.

19,301. Do you know how many of them died of plague?—I could not say, off-hand, not knowing the localities where they lived in, but very few of them died as far as I could ascertain.

19,302. How many of them died of other causes besides plague?—I could not say. You could not control the population as they came and went.

19,303. I take it that you saw no evil effects from Haffkine's inoculations, and that you do not know what became of the majority of the 2,000 people you inoculated. Have you observed any after-effects from the inoculation?—Among the sequelæ of its reactive developments, idiosyncratic and other, may be mentioned neurasthenia, dizziness, and, in females, hysteria, and an asthmatic condition, varying in degree.

19,304. How long after inoculation?—A month afterwards, one particular woman tells me.

19,305. Only one woman?—No, two women. One told me she had asthma occasionally up to the age of five. After that she had never had any asthma till the age of 40. She is 40 now, and she was inoculated and got asthma and she gets asthma now. The other was a young woman of 24 years of age. There was a history of asthma in that case up to about eight years ago. She has been free from asthma for eight years, but subsequent to inoculation she developed this asthma, which continued for about four months. She was treated by several physicians, not by me alone, but by other people, and the asthma has practically passed away, but she suffers from occasional attacks of mastitis, swelling in the breasts. I cannot understand the thing myself, but there it stands. I do not put it down to that at all, I cannot trace and will not trace the connection.

19,306. Have you noticed anything else?—Aphonia, with occasional exaggeration of hysterical conditions, recurrent attacks of mastitis, articular pains, and the development of rashes, erythematous, urticarial, and one case of petechial rash.

19,307. How long after the inoculation?—Varying times; the erythematous and the urticarial within a few days of inoculation.

19,308. Were they painful?—Yes, but they passed off; it was only a matter of 24 or 48 hours.

19,309. Anything else?—And a lichenoid rash which came later on, about a week after.

19,310. Did these rashes spread from the point of inoculation?—No.

19,311. They appeared anywhere?—Anywhere.

19,312. Have you any evidence to show that these people did not suffer from these rashes before? You know well enough that when children are vaccinated every rash the child gets afterwards is put down to vaccination. Do not you think this might be a similar case? Have you any evidence to show that these rashes were due to inoculation?—They were attributed to the inoculation.

19,313. Are you satisfied yourself that they were due to inoculation?—I have seen erythema and an erysipaloid condition after inoculation, but that I put down to want of careful asepsis.

19,314. Have you seen anything else?—Isolated cases of leucoderma and leprosy have been reported I have two cases, but they are not my cases.

19,315. Then you had better not mention them. You have not observed them yourself?—No.

19,316. Anything else?—I cannot say anything else. Practically I do not believe that these results are consequent upon inoculation, or in any way influenced by inoculation.

19,317. (*The President.*) All of them; the skin eruptions and so on?—The skin eruptions may be determined.

19,318. Were the last two—leprosy and leucoderma?—No, I could not say they were.

19,319. (*Dr. Buffer.*) You say in your précis that Haffkine's fluid is prone to putrefication: have you any facts fearing on that point?—If it stands in a bottle, it is liable to putrefaction.

19,320. It contains half per cent. of carbolic acid?—I cannot say; I am speaking of some months ago.

19,321. It putrified easily?—Yes it putrified easily. There is another curious thing in connection with this Haffkine's prophylactic fluid. We all know that perchloride of mercury is a powerful germicide, but it has no action on the toxine itself. I had used a serum bottle, and half was left. I took a strong solution of perchloride of mercury and poured it into this bottle and put this bottle inside a cage with rats, securing the bottle so that they could not by any chance drink the contents of the bottle, and over that I put a deal-wood box, and some of the rats were dead the next morning, but not with plague.

19,322. Did they drink it?—They could not drink it.

19,323. How could they get plague from the prophylactic fluid?—I did not say it was plague; it might have been toxinal poisoning.

19,324. How could they—are there any volatile substances—have you ever smelt one of Haffkine's bottles? I have frequently, but never found any smell?—I have frequently smelt them myself.

19,325. (*The President.*) What do you suggest,—carbolic acid poisoning?—No, I do not think so. Volatile toxine, I think.

19,326. (*Mr. Hewett.*) You say you were the first person to discover the mortality among rats in September 1896?—I drew the attention of the authorities to it.

19,327. Whose attention?—I mentioned the matter to Dr. Weir. He may have seen the rats himself, as he was continually down there.

19,328. Did you report it in writing to Dr. Weir?—No, I saw him personally.

19,329. (*Mr. Cumine.*) Perhaps the Commission did not understand the full significance of what you said about rats crossing the causeway. When you said that they crossed the causeway, you did not mean, I fancy, that they went from one side of the roadway to the other side, but that they ran along from one end of the causeway to the other end. Is that so?—Yes.

19,330. Are those causeways the causeways that cross the creek north of Bombay Island?—Yes.

19,331. What would be the length of the Bandra causeway?—I could not say,—some hundreds of yards.

19,332. You say you went there at night, and stopped to see if rats were passing?—I casually passed by.

19,333. You did not go specially?—I was told about it, and I casually went there.

19,334. What did you see?—I saw some rats running along.

19,335. Which way?—Towards the Bandra side.

19,336. Which way were you going?—I stood towards the Mahim side.

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19,337. Where did you stand in the roadway?—On the side of the roadway. I was in a carriage on the side of the road, not in the centre of the road.

19,338. How long did you remain there?—About three quarters of an hour.

19,339. How many rats passed?—I did not count them; several passed.

19,340. Did you follow them up to see if they went over to Bandra or were they only playing about on the causeway and did they return again to the Mahim side?—I did not follow them up, but I was told that, subsequentiy to this, other people had noticed the rat migration.

19,341. I want your rats please. When you had observed them for three quarters of an hour, did you go on to Bandra, or come back again?—I came back again.

19,342. You do not know whether they went right across the causeway?—I could not say.

19,343. Was there plague in Bandra at that time?—Yes, there was.

19,344. You cannot say whether these rats took plague across, or not?—I was told that they did. There was no plague up to the time of the rats going across.

19,345. Your rats?—Not my rats, but rats noticed by others.

19,346. I want to know about your rats?—Plague had been already over there.

19,347. Do you know whether rats go across every year, when there is plague and when there is no plague?—I could not tell you that. My attention was drawn to it, and I simply went there out of curiosity.

19,348. (*Dr. Ruffer.*) Did you ever see plague twice in the same person?—Yes.

19,349. Can you give us the details of the case or cases?—Yes. There is one case of a man who died in the Modikhana Hospital after three attacks.

19,350. Can you give us evidence of that case?—He was the grandson of Dr. Byramjee. He got over two attacks and succumbed to the third.

19,351. Did you see him after the two attacks?—No, I was told about it.

19,352. Who told you?—I asked Dr. Byramjee himself.

19,353. You yourself did not observe the case?—No.

19,354. Dr. Byramjee would be able to give us the details?—Yes.

19,355. Have you any other cases?—There was another case of a man by the name of Ghella, a Hindu. First of all he had axillary plague, and then four or five months afterwards he got parotid plague.

19,356. How do you know it was parotid plague?—By the symptoms, and he had high fever.

19,357. How do you know it was not mumps?—It was not mumps.

19,358. Did the man die?—No, he is alive now.

19,359. Can you find him and bring him here?—Yes, I will try and bring him here, unless he has run away to his country.

19,360. Have you any other cases?—I could not think of any just now. Some people have run away from Bombay, and the average native is very loth to come and appear before any Commission. They will tell you a good many things, but if you ask them to come and give evidence, they will not.

19,361. In the case in which you inoculated a person three times, did you find that the second inoculation produced more or less reaction?—It varied; there is no hard and fast rule.

19,362. Sometimes more and sometimes less?—Yes.

19,363. And the third inoculation?—The result was the same there, sometimes more and sometimes less.

19,364. You never inoculated a person more than three times?—Not more than three times, although some came and asked for a fourth inoculation, but I refused.

19,365. (*The President.*) I did not understand why you inoculated three times. I have no doubt you had some satisfactory reason. What was your object?—The object was this, that many of the people I inoculated complained that they were not able to rest in their houses during the period of this reaction, and they wanted a smaller dose, so that the reaction would ensue, but not so very pronounced a reaction.

19,366. Your object was to introduce by several small doses, each insufficient to produce inconvenience, a total quantity sufficient to cause immunity?—Yes, that is so.

19,367. In regard to the cases which you thought were plague cases, and where there was no glandular enlargement, had you any evidence of infection from one case of that kind to another?—No, not at that time.

19,368. Have you had any instance of infection from one person to another in the cases of glandular enlargement that you refer to?—From one to another I have.

19,369. Have you had cases where you had evidence that a patient suffering from plague with glandular enlargements conveyed that form to another patient?—I could not say definitely that it was directly from that man to another man, because people go in and out. The native customs are very peculiar. About 10 or 12 come and huddle up together in a room to see one man, and remain some hours, and then go away again to their houses.

19,370. So far, you have only had evidence that a man who has been infected in that way has had an opportunity of contracting the disease from another person similarly infected?—Yes, I have seen some cases like that in the latter years of the plague, but not in the initial cases.

19,371. In the early years that you refer to what prevalent diseases were there; were there any parexic diseases prevalent? Was tonsilitis common?—Yes, tonsilitis was present, but not to any great extent.

19,372. Did you satisfy yourself that these were not cases of acute tonsilitis? What I heard you say does not make it clear to me that they might not have been cases of acute tonsilitis?—The symptoms were so exaggerated. You do not get such exaggerated symptoms with tonsilitis.

19,373. You get a very high temperature, and prostration?—Intense prostration follows in those cases.

19,374. I do not see anything in what you have mentioned which would not be consistent with tonsilitis?—There was the general intumescence of the tissues extending right down to the clavicles.

19,375. That is the point, is it?—Yes.

19,376. You gave evidence about telluric conditions and you thought moisture of the soil might be an inducing, or an adding cause, at any rate?—A determining cause.

19,377. Is it within your knowledge that the plague bacillus thrives better in a moist surrounding than in a dry one? That is what you probably mean to say?—That is so.

19,378. What do you think is the manner in which rats infect human beings?—Rats die in a house, and perhaps, it is the exhalations from their bodies, like the exhalations from any corpse which has died of zymotic disease, and which is always prone to carry disease to others—small-pox, for instance.

19,379. By exhalation do you mean the volatile material that proceeds from a corpse?—Yes.

19,380. What volatile material proceeding from a corpse, whether that of a human being or an animal, would *in itself* produce plague?—If it is in a close atmosphere the possibilities are that there are exhalations from the body.

19,381. What volatile material do you refer to? Is it something different from the bacillus?—It is.

19,382. Is it possible that any other substance, excepting the plague bacillus, would cause plague?—No, it is not possible.

19,383. Then what is it you mean?—You might get intoxication.

19,384. You do not mean to say that anything but the plague bacillus, which is not volatile, would cause plague?—I do not.

19,385. With regard to Haffkine's prophylactic fluid, do you think that it is the want of "scientific potential value" which is the objection?—No, it is not an objection. It has not been determined, and I do not

advance that as an objection against the prophylactic at all.

19,386. It is a question to be investigated?—Yes.

19,387. Could you determine the potential value of an unit of this fluid?—Yes, by injecting, according to body-weight, a certain amount of the toxine or anti-toxine.

19,388. What would you do in this case? What would you test each against, and how?—By injecting rabbits or guinea pigs, and seeing the amount of resistance they may aquire, according to body-weight, against the virulent bacillus itself.

19,389. (*Dr. Ruffer.*) What do you mean by the potential value?—The resisting value in units to body-weight.

19,390. In units of what?—According to body-weight.

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19,391. Body-weight of what?—For instance, you take a guinea pig and you give it a certain dose of anti-toxine.

19,392. Is there any anti-toxine to Haffkine's fluid?—No. I am not talking about that; I am talking about anti-toxine in general.

19,393. You say anti-toxine. I want to know whether there is an anti-toxine to Haffkine's fluid. I have not heard of it?—I have not heard of it either. The amount of resistance or immunity conferred was not determined.

19,394. On animals?—Yes; it has not been determined. That is what I meant to infer. The other matter associating anti-toxines with Haffkine's fluid was far away from my ideas altogether, knowing, as I do, that it is a solution of plague toxine in neutral mutton broth.

(Witness withdrew.)

Mr. N. FUTEHALLY called and examined.

Mr. N. Futehally.

19,395. (*The President.*) You reside in Bandra?—Yes.

19,396. Are you a medical man?—No.

19,397. What occupation do you follow?—A merchant.

19,398. I believe you are Vice-President of the Bandra Municipality?—Yes, I was so until March last.

19,399. (*Mr. Hewett.*) Were you in charge of plague operations at Bandra at any time?—Yes.

19,400. From what date to what date were you in charge?—From October 1897 to April 1898.

19,401. During that period was plague continuously in Bandra?—There was plague in certain districts only—in two districts.

19,402. You mean to say in the villages round Bandra?—Yes, the villages included within the Municipal limits of Bandra.

19,403. When did it exist in those villages?—I first heard of a case in December.

19,404. What village was that?—In Khari village.

19,405. Did you have an outbreak in Khari then?—Yes.

19,406. How long did it last?—It lasted for 2½ months, I believe.

19,407. Did you evacuate the village?—Yes.

19,408. Did the plague spread from Khari to Bandra itself?—No, it did not.

19,409. What other village caught infection?—A village called Naupado.

19,410. How long did plague exist there?—About two months.

19,411. Did you evacuate that village?—No.

19,412. Did plague spread from Naupada to Bandra?—No.

19,413. When did you get your first case of plague in Bandra during the time you were in charge?—We had no case in Bandra then.

19,414. When was the first case in Bandra?—During the time I was in charge, there was no case in any other place except Khari and Naupada.

19,415. When did you actually give over charge?—On the 31st of March. I believe there were one or two cases in the middle of March.

19,416. Were there no cases in February?—No, not in any other part of Bandra, except the two villages of Khari and Naupada.

19,417. When did the first sporadic case take place, in March?—The first case in Bandra was in about the third week in March. There were three cases.

19,418. Do you know anything of the measures then taken in Bandra?—Yes, the measures were all taken by myself.

19,419. What measures were taken?—There were two sorts of measures, One sort had reference to the whole of Bandra generally, and the other had reference only to plague-stricken districts. With regard to Bandra town, including the plague districts, we did take some measures; that is to say, we had house-to-house visitation, examination at the station, and we issued notices that all new arrivals should report their arrival to the Municipal Officers, and we called upon the house-owners to give intimation to the Municipality of all new arrivals in their houses. Those were the general measures in all Bandra.

19,420. Whether as a result of those measures or not, plague did not touch Bandra while you were in charge?—That is so.

19,421. Since then it has broken out there?—Yes.

19,422. And has existed continuously?—Yes, it has existed continuously. Sometimes there have been great numbers, and sometimes there have only been a few attacks.

19,423. It is still there now?—Yes; it is rather bad.

19,424. Is Bandra subject to constant infection from Bombay?—Yes, it is subject to that.

19,425. When plague is bad in Bombay, are people in the habit of going to Bandra?—Yes, many people come to reside there and go daily to Bombay for business, and so are the Bandra people in the habit of going to Bombay for business.

19,426. Then the Bandra people are constantly liable to infection while doing their work in Bombay?—Yes.

19,427. Do you think that Bandra got infected by the residents of Bandra coming to Bombay and catching plague in Bombay?—The first case that occurred in Bandra was that of a woman who was resident in Bombay. She came to Bandra and brought plague with her. That was at the very first outbreak, not in my time.

19,428. I am now asking you what your opinion is as to how the place got infected after you gave over charge of operations?—I think the examination was not sufficiently strict.

19,429. The examination of what?—The examination of the people. We disbanded several of our Municipal Inspectors. The examination at the station was also discontinued, and so was the house-to-house visitation. As I have said in my précis, I believe it was through slackness of measures.

19,430. During your time were the people who went from Bandra to do their business in Bombay inspected?—Yes.

19,431. Was every individual regularly inspected?—Yes. We used to issue passes to the permanent inhabitants of Bandra who had business in Bombay. Every man had a pass, and before the pass was given to him he was examined. If he was found to be all right a pass was given to him. The pass would enable him to return to Bandra and it would say that he was a permament resident. Passes were also given to distinguished people who were not permanent residents at Bandra.

19,432. You contend that it was the abandonment of this system which led to plague getting into Bandra?—Yes.

19,433. Is that all you wish to say?—Yes.

(Witness withdrew.)

Prof. O. V. Muller.

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Prof. O. V. MULLER called and examined.

19,434. (*The President.*) Please to inform us what you are a Professor of?—History and Political Economy at the Elphinstone College, Bombay, the Government College.

19,435. (*Mr. Cumine.*) You are a volunteer witness, are you not?—Yes, I have been a volunteer all through.

19,436. When did your experience of plague begin?—I was present as a member of the Standing Committee the day Dr. A. Yiegas announced to us that there was plague in Mandvi. As soon as the meeting was over I got on my horse and rode down to Mandvi. I have been looking on and taking part in almost every sort of operation ever since,—taking notes and photographs from the very beginning. Having a historical knowledge of plague, I tried hard to discover how the plague spread, and how it could be stopped. I studied every possible detail.

19,437. How do you think it did spread from house to house in Bombay?—When I came down to Mandvi I found the plague was existing in some six or seven houses. I noticed that the houses where the plague was were very good houses, and very often in breezy situations, and facing the docks. Many of the rooms were very excellent. I should have had no objection to living in some of the rooms myself, especially the one where the plague was so bad in the beginning—No. 45, Argyle Road. Inspector Hallams and myself disinfected that house over and over again according to the methods then in vogue, with a fire engine and phenyle and water. We cleaned it from top to bottom and whitewashed it twice. As long as there were any people left in it the plague continued to attack them. Various theories were started. The natives said it was due to the European drains that had been put down in the town. I inquired into this matter, and found that although the drains were being cleaned in Mandvi in the infected district, and the silt taken out, not a single coolie suffered from any disease whatever, although they were handing the filth supposed to contain the plague. One person started the idea that plague was due to the grain stored in godowns under each of the houses where plague occurred. I volunteered to clear out one godown at the bottom of Argyle Road, No. 45; and I was given thirty coolies to do it. I saw these coolies for many days afterwards and not one was taken ill nor was I, although at the time I was looked upon as very foolhardy. I was one of the people who showed the public that a healthy European who took reasonable care was immune. My friends in Bombay treated me as if I were a leper, and society practically cut me as it was known I was on plague duty. I noticed immediately I came down that the plague was confined to a very small district on the east of the railway, and bounded at the two ends by two railway bridges. For some days it remained there, and then it gradually spread to the other side of the railway. In every godown we opened in the morning we would find twenty or thirty dead rats. To give you an example of the abundance of dead rats, when Mr. Hankin arrived he drove down to Mandvi, and asked me for some dead rats. In five minutes I got him twenty in and around the houses in Dongri Street. He said he wanted some freshly-killed rats. I went into a house and turned over some bales. Rats ran out in all directions, and I pursued and killed some with my riding whip. They were all sick. I noticed rats on the Masjid Bunder Bridge running about as if they were drunk. You could see them lying about the streets in quantities. I have never in any other part of the town seen sick, dead, and dying rats in such quantities. Mandvi being the centre of the grain godowns, there are, perhaps, more rats than anywhere else. On hearing that this district (which contained good houses, and streets laid out at right angles) was attacked, and that rats were sick with plague, I went down to inquire from P. and O. Officers whether there was any possibility of rats coming from Hong Kong, and I was told that at Hong Kong the ships go up against the quay, so rats can both leave and go on to ships. The same applied to Bombay, but to no intervening port. From this I came to the conclusion (which I have always held, and always pointed out to foreign scientists) that plague was brought here by sea by sick rats from Hong Kong. Plague spread a week or two afterwards to Karachi—before it did to Thana or Poona. I thought my theory was confirmed by the fact, that it went by sea to Karachi much quicker than it moved by land to even neighbouring towns. Mr. Vincent, the Commissioner, has told me that he held the theory that the Sadhus from the Himalayas brought it, but personally I have always been convinced of the opinion that it came from Hong Kong in ships by sick rats. Every sailor will tell you that at every port where ships go up against the quay, rats will go on board, and also leave the ships. I should like to mention a fact which I think helped to spread plague in the beginning. Plague practically began in two houses, 45, Argyle Road, and 22, Clive Road, containing respectively 400 and 600 people; and the people fled all over the town. At first we could not get them to move. They did not care; they looked out of the windows when disinfection was going on, but afterwards they fled, and those two houses became quite empty. Then I noticed another thing. Down in the Masjid Bunder Siding Road several rich men subscribed three or four thousand rupees, and gave a huge caste dinner four days after plague broke out on the 28th of September. People were invited from all parts of the town, and were feasted in an infected house to propitiate the Deity. I urged the men rather to spend the money in white-washing these houses. The people however went and feasted there, and kept it up nearly the whole night, and then went back. Whether these people carried infection or not I was unable to ascertain.

19,438. Did you try any experiments to see whether the theory that grain spreads the plague was correct or not?—When Dr. Waters pointed out that certain grain godowns were "obviously (?)" causing plague, I got sterilised bottles; I used soda-water bottles; I went to each godown he had specially pointed out; I opened the bottles, poured the soda-water out, and took grain from where it would be most infected; I sealed the bottles, and disinfected my hands between each operation. I took the bottles to Mr. Hankin; he inoculated rats with the contents, but he failed to discover any trace of plague whatever.

19,439. Did any bad results occur to the coolies you got to assist in removing grain from the godowns?—No. I undertook to empty the godown he pointed out as particularly bad. I had 30 coolies given to me for the work; I took a careful note of them, and none of them got ill at all.

19,440. (*The President.*) How were these coolies dressed?—They were almost naked.

19,441. Were their feet covered?—No. It was very hot work. They took off what little clothes they had, all except a band.

19,442. (*Mr. Cumine.*) Will you kindly tell us whether there is any point which came to your notice, and which, so far as you know, has not been mentioned by any other witness?—I did notice that several people whose names I took down who fled from Mandvi afterwards caught the plague in other parts of the town. I know of seven people whose names I took down who left infected houses, and who afterwards died of or developed plague. With regard to rats dying before cases of plague occurred in a house I may mention I noticed that whenever dead rats were found in servants' quarters, and ladies told me of this at the Yacht Club, 10 days or a fortnight afterwards (almost with the regularity of clock work) their servants would arrive at my Servants' Plague Hospital. I have noticed too that cases have been very frequent in low-lying huts and houses, especially in houses with earthen floors; while houses with pukka floors, *i.e.*, tiles, cement, or the like remain immune. I have known fairly good houses with earthen floors which were not as immune as those with cement or stone-floors. I have also noticed that when plague comes into the neighbourhood of a village, if the whole village leave their houses and remain out until the rains there were no cases among them.

19,443. (*The President.*) It stopped plague?—Yes.

19,444. Can you mention any villages?—There is the village of Ghowari.

19,445. What is the population, large or small?—Not very large, some thousands.

19,446. Any other village?—I cannot speak with exactness except with regard to Ghowari. That I am quite certain of, because I was in charge of it. Then there is another point. I noticed that the Christian section of the village of Vadala did not suffer as much as the Hindus. They said, "We do not get plague

because we sleep on beds." I took a note of that, and I found that almost every Christian villager had a bed, whereas almost all the Hindus slept on the ground.

19,447. Why do you think that healthy Europeans are relatively immune?—I think because we wear boots and sleep on beds. Our houses are lighter, and more airy, and we keep our neighbourhoods clean.

19,448. You do not, I suppose, mean that the immunity is specially racial; if a Hindu lived under the same circumstances, he might also be relatively immune?—To a large extent. I believe it takes more plague virus to give a European plague than a native. Speaking personally, I have been scratched by plague patients and treated in various ways, I should think, that would have given a native plague.

Prof. O. V. Muller.

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19,449. Were any of these rats that you have referred to bacteriologically examined?—Yes, I frequently took them to the laboratories. My friends took to sending them to me in biscuit tins to have them examined, a practice I soon stopped.

19,450. I am referring to the rats at the commencement of the outbreak: were they bacteriologcally examined?—Yes, by Mr. Hankin and others.

19,451. Those for example, which seemed to you to have been the immediate cause of the importation of plague, were they examined?—Yes, rats were examined, which came from Nenaz Kairaz's house in Dongri street in Mandvi, where there had been cases, and where I killed rats for Mr. Hankin. He showed me afterwards a section of the spleen of one of the rats with a colony of microbes in it.

(Witness withdrew.)

Mr. J. K. N. KABRAJI, I. C. S., called and examined.

Mr. J. K. N. Kabraji, I.C.S.

19,452. (*The President.*) You are Acting Collector at Kaira?—Yes.

19,453. You have seen plague in a large number of villages, I think?—Yes.

19,454. With regard to the first village mentioned in your précis of evidence, Igatpuri, the importation, I understand, was from Bombay?—Yes; we had five cases in January 1897, five in February, one in March, and three in April, and then, after the middle of July suspicious cases began to occur in a line of houses on the Agra Road, and the presence of plague was recognised. The infection was believed to be introduced by a Muhammadan who came from Bombay about the middle of July and died soon after.

19,455. What were the measures taken when plague showed itself there?—In the first place the sick were taken to the hospital, but the other inmates of the infected houses could not be removed easily on account of the heavy rainfall. They were just taken out for a few days while their houses were disinfected, and then they were allowed to go in again.

19,456. None of the neighbours were removed, I suppose?—No.

19,457. What was done to the houses?—The houses were disinfected and lime-washed.

19,458. Therefore you had a very imperfect evacuation, but I suppose there was complete disinfection?—Yes, there was complete disinfection.

19,459. What is the result?—The result was that there was no improvement, that is, plague had its course for two or three months and then subsided.

19,460. The result was that the plague went on increasing?—Yes.

19,461. You thought you would anticipate plague by disinfecting the houses which had not been infected?—Exactly.

19,462. What is the result of that?—The result was that plague went there just the same.

19,463. You did not succeed in your object of preventing the extension of the plague?—No.

19,464. What was the disinfection you employed?—Perchloride of mercury only.

19,465. Was that done thoroughly?—I believe it was; there were men specially looking after it.

19,466. Was it under your observation?—Major Anderson was looking after the whole arrangements.

19,467. It was not under your observation?—No; there were special men told off.

19,468. What did you afterwards do there?—At Igatpuri nothing more was done except that we got a lot of waggons from the Railway Company. That was about the time when only railway employés were living in the place with their families, all the others having gone away. A number of waggons were obtained and the people were put in them, and then all the houses were vacated.

19,469. What was the further history of the plague?—After that the plague subsided about the end of October.

19,470. By that time, therefore, there had been a comple evacuation effected, following the incomplete one?—Yes.

19,471. And the result was that plague ceased?—Yes.

19,472. Have you had any experience in Bijapur?—Yes.

19,473. The measures you employed there were of a similar nature, were they not?—In the first place there was a small outbreak at Kaladgi in February 1898. There the measures were of a similar nature, but there was complete evacuation at the same time; that was in the dry season.

19,474. The great difference is that in this instance you were able to get complete evacuation carried out, as contrasted with the former village?—Yes.

19,475. How does the history of plague here contrast with the history of plague in the former village?—In Kaladgi, after evacuation, the plague disappeared in almost no time—in two weeks. We did not disinfect every house in this case, but only the infected houses and those in the neighbourhood. The other houses in the town were cleaned out and lime-washed.

19,476. Had you experience in any other villages?—After that the real epidemic began in August last year at Ilkal. There, again, it was in the rainy season, so in the first place the people were taken to the hospitals, but after a time, I think two or three weeks after it commenced, the whole town was evacuated, and people were made to go into their fields. There was not much rainfall, so we were able to do it.

19,477. What occurred with regard to the plague?—There, too, plague subsided.

19,478. And entirely stopped?—Yes, the last case being on 15th November, 1898.

19,479. Had you any satisfactory measures for discovering cases of plague?—I employed a lot of men in the surrounding villages, in fact, in the whole taluka. It was their business simply to go round and visit two or three villages a day, and inspect new arrivals, and every house where deaths had taken place. In that way we were able to detect a number of infected villages at the very beginning.

19,480. Do you think that very important?—I think so, because it happened in some of the cases that we detected the first or the second case of plague and the village was turned out, and after that the mortality was very little.

19,481. You have had other instances in which complete evacuation had been effected, I think?—Yes.

19,482. Was the result in them the same?—We have always noticed that plague went down after evacuation.

19,483. Where the evacuation was only partial it did not go down?—No.

19,484. What was the result when you adopted disinfection only?—I cannot say that disinfection did any harm, but I consider it was simply thrown away—all the money was thrown away on disinfection. We got just the same result without disinfection. I simply compare Igatpuri with Ilkal. At Igatpuri we disinfected every house, and in some cases we disinfected streets in advance of plague before they got infected. All the same, plague went there.

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19,485. Into these very houses?—Yes. At Ilkal we did not do any such thing.

19,486. How soon after disinfection were the houses re-occupied at Igatpuri?—They were allowed to go in within three or four days. It sometimes took three or four days and sometimes a week. At Ilkal the people were turned out but only the infected houses were disinfected, and then the people were allowed to go in again, and the results have been the same with very little cost.

19,487. Can you tell me the result?—At Ilkal plague subsided two months after, practically, and it did so also at Igatpuri. In spite of disinfection it took two months before plague was got under there. At Igatpuri the people were allowed to go in after that time and also at Ilkal, and there has been nothing since at Ilkal.

19,488. In both cases it stopped?—Yes.

19,489. Can you contrast disinfection with complete evacuation?—There was no evacuation at Igatpuri for some time, but at Ilkal we started evacuation within a month of plague appearing there.

19,490. How soon after evacuation did plague disappear?—At Ilkal plague disappeared in three weeks after evacuation; at Igatpuri it went on for a long time in spite of disinfection.

19,491. Will you tell us what you mean by a "long time"; was it months or weeks only?—At Igatpuri we had the first recognised case on the 2nd August, and the last case on the 2nd November.

19,492. It went on for three months?—Yes.

19,493. Have you the details?—I have a statement for Ilkal also which shows that at Ilkal it subsided in somewhat less time. I put in those statements.

IGATPURI.

Date.	Attacks.	Deaths.	Date.	Attacks.	Deaths.
1897			1897		
Aug. 2 -	6	1	Sept. 21 -	11	6
„ 3 -	1	3	„ 22 -	8	7
„ 4 -	3	3	„ 23 -	6	4
„ 5 -	1	0	„ 24 -	7	6
„ 6 -	2	1	„ 25 -	9	4
„ 7 -	1	3	„ 26 -	2	5
„ 8 -	0	0	„ 27 -	6	3
„ 9 -	2	0	„ 28 -	8	9
„ 10 -	0	1	„ 29 -	1	3
„ 12 -	7	2	„ 30 -	6	7
„ 13 -	0	0	Oct. 1 -	0	0
„ 14 -	3	2	„ 2 -	8	7
„ 15 -	1	1	„ 3* -	4	3
„ 16 -	3	1	„ 4 -	8	8
„ 17 -	2	2	„ 5 -	8	8
„ 18 -	4	4	„ 6 -	6	0
„ 19 -	6	1	„ 7 -	4	1
„ 20 -	3	5	„ 8 -	5	5
„ 21 -	1	2	„ 9 -	2	1
„ 22 -	3	1	„ 10 -	4	3
„ 23 -	1	3	„ 11 -	4	1
„ 24 -	9	2	„ 12 -	4	3
„ 25 -	10	3	„ 13 -	4	4
„ 26 -	8	10	„ 14 -	4	4
„ 27 -	6	5	„ 15 -	4	5
„ 28 -	6	3	„ 16 -	1	1
„ 29 -	8	7	„ 17 -	0	1
„ 30 -	14	13	„ 18 -	4	1
„ 31 -	15	9	„ 19 -	0	0
Sept. 1 -	16	18	„ 20 -	0	4
„ 2 -	13	10	„ 21 -	0	1
„ 3 -	21	19	„ 22 -	0	0
„ 4 -	10	11	„ 23 -	1	1
„ 5 -	20	16	„ 24 -	0	0
„ 6 -	14	12	„ 25 -	6	2
„ 7 -	8	12	„ 26 -	1	0
„ 8 -	20	11	„ 27 -	0	0
„ 9 -	2	4	„ 28 -	0	0
„ 10 -	6	8	„ 29 -	4	0
„ 11 -	12	5	„ 30 -	0	0
„ 12 -	12	6	„ 31 -	0	0
„ 13 -	13	12	Nov. 1 -	0	0
„ 14 -	9	6	„ 2 -	2	0
„ 15 -	6	12	„ 3 -	0	1
„ 16 -	14	10	„ 4 -	0	1
„ 17 -	13	8	„ 5 -	0	0
„ 18 -	11	5	„ 6 -	0	0
„ 19 -	8	5			
„ 20 -	6	9	Total -	512	411

* Date waggons were used.

ILKAL.

Date.	Attacks.	Deaths.	Date.	Attacks.	Deaths.
1898			1391		
Sept. 17 -	5	2	Oct. 18 -	13	11
„ 18 -	1	0	„ 19 -	15	16
„ 19 -	0	2	„ 20 -	11	8
„ 20 -	4	0	„ 21 -	15	11
„ 21 -	3	0	„ 22 -	8	10
„ 22 -	1	2	„ 23 -	4	3
„ 23 -	4	4	„ 24 -	4	2
„ 24 -	4	3	„ 25 -	3	5
„ 25 -	3	3	„ 26 -	4	1
„ 26 -	1	3	„ 27 -	1	3
„ 27 -	0	0	„ 28 -	8	5
„ 28 -	1	0	„ 29 -	1	2
„ 29 -	0	1	„ 30 -	1	2
„ 30 -	4	1	„ 31 -	2	2
Oct. 1 -	2	1	Nov. 1 -	5	5
„ 2 -	1	0	„ 2 -	7	1
„ 3 -	5	4	„ 3 -	2	2
„ 4 -	5	4	„ 4 -	3	3
„ 5 -	10	4	„ 5 -	0	1
„ 6 -	2	4	„ 6 -	0	1
„ 7 -	6	8	„ 7 -	1	0
„ 8 -	4	3	„ 8 -	1	1
„ 9 -	11	6	„ 9 -	1	1
„ 10 -	11	10	„ 10 -	1	1
„ 11 -	9	7	„ 11 -	0	0
„ 12 -	12	10	„ 12 -	3	3
„ 13 -	16	9	„ 13 -	2	1
„ 14 -	7	15	„ 14 -	0	0
„ 15 -	13	14	„ 15 -	2	1
„ 16 -	5	7	„ 16 -	0	1
„ 17 -	16	8			
			Total -	284	238

19,494. How soon after complete evacuation did it subside at Ilkal?—Evacuation at Ilkal commenced in the beginning of October and was completed about the 3rd week of October. By about the 20th of October the whole town was out, and completely evacuated. The last case occurred on the 15th November.

19,495. When did the majority of cases occur after evacuation?—The highest mortality was just about the middle of October.

19,496. How many days after evacuation is that?—I should think evacuation was just near finishing by that time.

19,497. How many cases were there after complete evacuation?—After that cases went down from 15 to eight, four, five, and so on, and on the 5th and 6th November there were no cases.

19,498. What do you think is the reason that complete evacuation is so efficacious?—I consider the chief reason is that people go into the fields, where they get plenty of light and air.

19,499. Why do you think so?—Because that is the only difference that I can see between huts in the field and the houses in the town.

19,500. Generally speaking, the houses with which you have been dealing were defective in those respects?—Native houses are always badly ventilated.

19,501. And always badly lit, do I understand?—Yes.

19,502. Were they overcrowded?—In many cases they were overcrowded.

19,503. Generally speaking, or not?—Yes, generally speaking, they were overcrowded for villages of that stamp, but not to the same extent as in Bombay.

19,504. Had you any experience of preventive inoculation?—I have not had much experience of preventive inoculation. At Ilkal we inoculated people after the town had been evacuated, and before they were allowed to go into their houses. A few families were allowed to stay in the town after being inoculated; they were not turned out.

19,505. Did any harm result?—No. There were a few cases. I think 12 deaths occurred among the inoculated people, but they occurred two or three days after inoculation, so that they were, perhaps, already infected.

19,506. These 12 cases might have carried on the infection in the village which they were allowe to remain in?—Yes, they might.

19,507. There is a certain amount of danger there?—Yes.

19,508. You have formed some opinion as to the time which elapses between the first importation of a plague case and the actual occurrence of an outbreak?—Yes.

19,509. Will you give us the facts?—The first time it attracted my notice was at Igatpuri, where I ascertained that some Muhammadans came from Bombay in the middle of July. The first death among them was on the 21st July. Then it was nearly 12 days before any further deaths took place in that locality.

19,510. You always received early information? Your machinery was adequate?—Yes; but we did not receive information about these arrivals from Bombay, because we had stopped medical inspection just about that time.

19,511. You found that out afterwards?—Yes.

19,512. Have you any other case?—I observed it more closely at Ilkal, where a man, who was suspected to have brought the infection, died on the 31st of July, and the first death which took place in that house afterwards was on the 20th August. On the 31st July a Marwari Banniah came from Hubli, and died at Ilkal. That death passed unnoticed. Then the man he had been living with died on the 20th August, and his wife on the next day. That started the plague at Ilkal.

19,513. That was the second case?—Yes. After that I have had some other instances. As one illustration I may say that in this way I detected what, I believe, was the first indigenous case of plague ot Bobleshwar, a large village in the Bijápur táluka. It is situate between two infected villages. I told the people they were in imminent danger, and advised them to live in their fields as a precautionary measure. They emphatically said they had had no communication with either of the infected villages. They, however, assented to my suggestion to thoroughly ventilate their houses. This they set to do, but while I was inspecting the progress made and also visiting the houses where deaths had taken place within the preceding four weeks, I came upon a house where that very morning (17th December) a man had died in a certain house and I was informed that his wife had died in the same house on 23rd November. After a deal of cross-examination it was brought out that the woman had been to a funeral at Kakhindki, one of the infected villages in question. Two days after her return she had died. Regarding this, therefore, as an imported case, and allowing three weeks for full incubation, I came to the conclusion that the husband must have died of plague. I also ascertained that three days before his death he had been seen going about. I therefore segregated that family as also those of the brother and the sister of the deceased—occupying adjoining houses. In another house, at the back of the first one, the wife of the occupant was absent, and was said "to be living at her father's house for some time." She was visited there and found to be feverish. She, as well as her parents, were segregated. On the third day following she died, apparently of pneumonic plague. Two of the sons of the first case, as well as his brother, also developed plague (as pronounced by a Hospital Assistant) in quick succession. By this time all the people of the village voluntarily cleared out in two days. After this there was no fresh case or death for whole week; and there had been only five cases and three deaths up to that time. Unfortunately, it so happened that I had allowed a woman, who was very near confinement, to stay in her house with her husband and children, as I thought there was no immediate risk of that locality being infected. Almost all the members of that family, however, got plague after a few days, and were the means of spreading the disease among others living in the fields. Barring this mishap, I consider that Bobleshwar is a notable instance of the success attending immediate evacuation if the first case of plague is spotted. It also shows that it is not enough to evacuate the portion of the village which is immediately infected, as other localities eventually get infected. This happened, although I had caused the roofs of all the houses in the infected block to be completely removed within three days. I understand, also, that dead rats were subsequently found in different localities, even after the people had quitted the houses.

19,514. Is the interval, elapsing between the first imported case and the first local case, the same in dry weather as it is in damp weather?—I think it is shorter in damp weather. I have given some instances and can give others to show that nearly three to four weeks elapse before an imported case, if left alone, causes indigenous plague in a hitherto uninfected locality. This fact helps to detect the first signs of plague. The period may be shorter in damp weather. This interval of time should be always borne in mind in calculating the effect of the admission of people from infected areas into another place, and raises important considerations as to the safety of the present surveillance and detention system. I have further observed that cases of plague are sometimes developed in the fields 10 to 20 days after evacuation, although the people have not mingled with infected persons.

19,515. What do you say with regard to disinfection?—Except at Ilkal, disinfection with perchoride of mercury was abandoned, and the infected houses were only ventilated, generally by removing the roofs altogether. This is easy to do, as in that part of the country the houses are only one-storeyed with flat mud roofs, which it costs little to renew. The very poor persons can be compensated. From my experience I think disinfection, considering its cost and other drawbacks, has not been proved to achieve the purpose for which it is undertaken. It is not proved that immediately a house is disinfected after an infected family is removed from it, another healthy family can safely go and live in it, much less the original family. Disinfection in advance, too, has failed, as I have said above. On the other hand, the very fact that a properly made Plague Hospital does not require to be disinfected every time a case dies, and that the medical and other attendants can safely live in it, shows that disinfection must be a superfluity in other infected houses, provided other conditions are the same, and I fail to see what they can be but the ventilation—the free admission of daylight and fresh air. With this view we insist that when people evacuate a village and go into the fields they should not create the same unhealthy conditions again by making air-tight and badly-lighted huts as they are prone to do, but should leave plenty of passage for light and air. If disinfection is authoritatively given up or condemned, it will not only result in a saving of nearly half of the cost of operations in rural areas, but will remove a highly fruitful source of irritation to the people, so that still another inducement to conceal will be taken away. It has been observed that by far the largest majority of plague cases, if not all, occur when the sleeping-rooms are badly or insufficiently ventilated or lighted. Even if there are windows or ventilators, the people are in the habit of closing them at night. This may sufficiently account for the occurrence of plague among the well-to-do classes. On the other hand, people living in open spaces, even in filthy surroundings, escape infection. I think ventilation should have precedence even over the cleaning up of houses and streets. It is advisable not to stir up the refuse of ages until some time had elapsed after the evacuation of a house or locality. This would also minimise the occasions for people to re-enter evacuated villages. Ventilation should immediately follow evacuation, but the cleaning may stand over for a month or so, and be carried out a few days before it is proposed to let the people in again.

19,516. (*Mr. Cumine.*) Have you had experience of two epidemics in one district?—No, not actual experience. I only know that at Igatpuri there has been a recrudescence lately.

19,517. From what place did the case come which infected the Bijapur district?—There were practically two epidemics in the Bijapur district, one at Kaladgi, which was stopped, and then, after some months, it broke out at Ilkal.

19,518. From what places did the two cases come which set up these two epidemics?—At Kaladgi, it was supposed that some people had come from Sholapur, which was badly infected at that time, and at Ilkal it was thought the man had come directly from Hubli, but they said he had also come from Bombay with a pass some days before. He came first from Bombay to Hubli and stayed there, and then came on to Ilkal and died there. Hubli was badly infected then.

19,519. Did you have instances of people coming from Bombay and developing plague in villages in the Bijapur district and not infecting the villages?—I have not come across any.

(Witness withdrew.)

(Adjourned till Monday next.)

At The Secretariat, Bombay.

FIFTY-FIRST DAY.

Monday, 20th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.
Prof. A. E. WRIGHT, M.D. | Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. B. N. Darabsett.

20 Feb. 1899.

Mr. BARAMJEE NAOROSJI DARABSETT called and examined.

9,520. (*The President.*) I believe you are a practitioner of medicine in Bombay?—Yes.

9,521. What are your medical qualifications?—I am a graduate of the Grant Medical College, and I have practised here for the last 39 years.

9,522. We chiefly want to have some information in regard to one special case which I believe you have had under your care, a man who we are told has had three attacks of plague. Would you be good enough to give us a narrative of the case of this man?—Yes. The notes I have here have been put down from memory. Munchershaw was a young Parsee, aged 26, residing in Modi Street.

9,523. In what district is that?—In the Fort. He was of fair complexion and sanguine temperament, strong, healthy, and hale. He was of fair stature. The first attack he had was in Poona. He had been there for a change for about 10 days. About the 10th of February he had shivering and an attack of fever, followed by swelling in the right inguinal gland. He was then treated with brandy, quinine, diaphoretics, and belladona plaster, the ordinary treatment for fever. He got well in about 15 days.

9,524. Had he been inoculated?—No.

9,525. That was the first attack?—Yes. He got over that. The second attack occurred about the middle of April 1897. The attack came on with shivering and high fever. After a time there was a rusty-coloured sputum, with crepitations in the lungs. He was treated similarly internally, and was frequently sponged with carbolic acid lotion.

9,526. On which side did the enlarged glands occur?—On the left side. He had an enlargement on the left side in the second attack. In the first attack it was on the right side. The inguinal glands on the left-hand side were enlarged, and he was treated with an inhalation of carbolic acid with steam, and frequent external spongings with carbolic lotion. This time he recovered in 20 days. On neither occasion was there any suppuration of the inguinal gland. The third attack was on the 25th of January 1898. It commenced with high fever and shivering, followed by hæmorrhage from the nose and lungs. No glands in the groin were enlarged, but enlargement of the gland in the neck and chest appeared the day previous to death. No inguinal glands were affected on the third occasion, but he again had pneumonia and hæmoptysis.

9,527. Were the glands within the thorax affected, the mediastinal glands?—Yes.

9,528. How did you find that out?—He complained of a very severe pain in the chest. We were obliged to inject morphia hypodermically.

9,529. How do you know that the glands within the chest were enlarged?—Because of the chain of glands extending down into the mediastinum.

9,530. Part of the neck was enlarged?—Probably the glands could not be felt at first. The man died on the 1st of February after an illness of about six or seven days.

9,531. Was there any *post mortem* examination?—Certainly not; he was a Parsee.

9,532. What was the man's occupation?—He was employed as a clerk in a photographic office.

9,533. Can you tell us to what extent he was exposed to plague before any of these attacks?—He was exposed to plague; he was living in a plague house.

9,534. On which of these occasions?—On all three occasions he was in the same house.

9,535. He came from Poona, did he not?—The first time he was in Poona. The very next day after the attack he returned to Bombay, to Bazar Gate Street, and he was treated in Modi Street for the last two attacks.

9,536. With regard to the first attack, he was at Poona and came to Bombay. Did he become ill in Poona or in Bombay?—The fever commenced in Poona.

9,537. With regard to that attack, what was the exposure to plague—the first time?—The first time, I should think, he exposed himself in Poona.

9,538. What was the exposure in the second attack. How was he exposed to your knowledge?—Plague cases occurred in the house he lived in.

9,539. And the third attack?—The same. Previous to his dying there had been two deaths from plague in the same house.

9,540. Had not the house been disinfected before he became ill?—Very perfunctorily—just whitewashing with lime. At that time strong disinfectants were not used. Latterly, however, they have been used more freely.

(Witness withdrew.)

Mr. Champaklal Thakurdas.

Mr. CHAMPAKLAL THAKURDAS called and examined.

19,541. (*The President.*) What is your occupation?—I am in Government service. I am an Inspector in the Bombay Custom House.

19,542. (*Dr. Ruffer.*) When did you first have plague?—On the 11th of October 1896.

19,543. Can you describe the symptoms you had at that time?—That day, being Sunday, in the evening I went to visit a friend of mine. At that time I was living in Kandawdi near Girgaum. My relative was living near Kalbadevi. On reaching half way I got some pain in the left groin. I did not care for the pain, and I at once proceeded to the house of my relative. I sat there for half-an-hour, but in the meantime I began to shiver from the effects of cold. I informed my relative about it, and he predicted that this would be followed by high fever.

19,544. Did a swelling appear in the groin?—It appeared afterwards.

19,545. When?—An hour or so after I got the fever.

19,546. How long did the swelling last?—It lasted for four days.

19,547. Did it suppurate, did matter come out of the bubo?—It was not operated upon. It subsided by the mere outward application of a plaster.

19,548. What was the highest fever you had?—My temperature went up to 105°.

19,549. Had you ever had an attack like that before?—No, not before that.

19,550. Are you a married man?—Yes.

19,551. Did you have any pain anywhere else at that time?—Only in the left groin.

19,552. You had no pain in the testicle?—No.

19,553. Or anywhere else in that region?—Nowhere else.

19,554. Did you have any pain in the abdomen?—At that time I had no pain anywhere else.

19,555. The swelling went down in five days?—Yes.

19,556. How long did the fever last?—Five days. For two days my temperature was 102°, and on the third day it was 102°. Then it began to subside, and on the fifth day I was all right.

19,557. Was your appetite good?—I did not take food all the time.

19,558. Did you want to eat, or not?—On the first day I did not want to eat, but on the second day I thought I was feeling hungry.

19,559. What was your tongue like, do you know?—I was very thirsty.

19,560. Do you know whether your eyes were red?—My eyes were red.

19,561. How do you know?—They told me so.

19,562. You got quite well of that?—Completely.

19,563. When was the second attack?—On the 29th of March 1897.

19,564. Where?—That day I attended office, and while going home in the evening I felt rather uneasy, and on the road I felt pain in the very same part.

19,565. Had the gland remained enlarged between the first and the second attack? Was the swelling you had the first time still to be felt when you had the second attack?—Although there was no pain there was a small gland inside the skin which could be felt, but it did not cause any pain.

19,566. How long did the second attack last?—Very nearly three months.

19,567. How did it begin, with fever?—First of all I felt some pain in the same place. That pain afterwards subsided when I got fever.

19,568. How long did the swelling last in the groin?—In the second attack it was cut open.

19,569. When was it cut open?—After 15 days.

19,570. Why was it cut open?—Because it was ripe.

19,571. There was matter in it?—Yes, there was matter in it.

19,572. Did you have a swelling anywhere else?—When the suppuration was going on I felt some electrical current passing from that part to the middle of my thigh, where I have another cut. On the next day there was another swelling.

19,573. What was that other cut in the middle of the thigh; why did you have another cut there?—They operated upon it in the hospital.

19,574. Afterwards?—Yes. On the next day there appeared some swelling on that part. That was also poulticed. After eight days that was also operated upon.

19,575. And pus came out?—Yes, and pus came out.

19,576. Did you have any swellings anywhere else?—The same swelling appeared in the groin.

19,577. When was that?—That was some 10 or 12 days after the operation.

19,578. How long did that swelling last?—That swelling lasted until I recovered.

19,579. How long was that?—I think some portion of it remains now.

19,580. How long after the first, second, and third swellings had been opened did they remain open?—The first healed in 15 days, and the second also took 15 days.

19,581. What about the third?—The third was not opened.

19,582. It healed up without being opened?—Yes.

19,583. Did you have headache the first time you had plague?—The first time I had no headache.

19,584. Did you have headache the second time?—No.

19,585. Did you have any delirium the first time?—No, I had no delirium the first time, but the second time I had.

19,586. How long did it last?—It lasted for nearly two days.

19,587. Were you seen by a medical man each time?—On both times I was seen by a medical man.

19,588. Who was the medical men who saw you the first time?—Mr. V. S. Divan.

19,589. Did he think you had plague?—Afterwards he took it to be a plague case.

19,590. He did not at first take it to be a plague case?—No.

19,591. The second time he had no doubt about its being a plague case?—No. He removed me to the Plague Hospital.

19,592. Did any of your relatives get plague either on the first or second occasion?—No.

19,593. Was there any plague where you lived?—No.

19,594. Did you feel very weak after the second illness?—Yes, I was very weak.

19,595. How long did the weakness last?—For three months.

19,596. Were your eyes injected—red—the second time?—I do not remember.

(Witness withdrew.)

Mr. NARAYAN MULJEE called and examined.

(*Dr. Godinho acted as interpreter.*)

19,597. (*The President.*) What was the date of your first attack of plague?—September 1896.

19,598. What glands were then affected?—The glands in the right groin.

19,599. How long did that attack last?—A month and a quarter.

19,600. By whom were you treated?—I was treated by Dr. Ismail Jan Mahomed.

19,601. Where?—I first went to him, and then he called upon me.

19,602. Where is your house?—Nos. 2, 4, and 6, Falkand Road, C. Ward, opposite Dr. Ismail Jan Mahomed's dispensary.

19,603. When was the second attack?—A month and a half after I recovered from the first attack I got the second attack.

19,604. That would be about November?—Yes.

19,605. Which glands were then affected?—The cervical gland on the left side.

19,606. How long were you ill?—About a fortnight.

19,607. Were you treated in the same house?—I did not take any medicine from the doctor; I was treated at home.

19,608. When was the third attack?—In the month of August 1897. First my brother was attacked and then my father was attacked.

19,609. What glands were affected?—The glands in the right axilla. I was operated upon for that.

19,610. How long did the third attack last?—A month and a half, six weeks.

19,611. On which occasion were the glands opened?—Only once; on the third occasion.

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19,612. Do you know if you had been specially exposed to plague infection?—I cannot give any cause for the first infection. I took the second infection from my tenants.

19,613. What tenants? How long had they been ill before you became ill?—I do not remember how long before.

19,614. Was it before you were ill?—They were ill before I was ill.

19,615. Was it a week or a month before?—Within 15 days.

19,616. Were you living in the same house?—Yes.

19,617. How did you get the third attack?—First, my brother was attacked. He died. Next, my father was attacked, and he died. Then I was attacked; and after me four others were attacked.

(*Dr. Godinho.*) I remember about those four cases.

19,618. (*The President.*) Had you been inoculated?—No.

19,619. I suppose there was no bacteriological examination?—(*Dr. Godinho.*) Nothing was done in 1896.

19,620. (*Dr. Ruffer.*) Did you have other symptoms besides enlarged glands, did you have headache?—First I had severe pains in the head, and next, I had nausea and vomiting.

19,621. Did you have fever?—Yes. Those symptoms were immediately followed by fever.

19,622. How long did the fever last on the first occasion?—About 16 or 17 days.

19,623. (*The President.*) How do you know that?—I was unconscious for seven days, and afterwards I became all right.

19,624. You said the fever lasted 16 or 17 days; how do you know?—I did not move from home, that is how I know it.

19,625. (*Dr. Ruffer.*) Did you have any fever on the second occasion?—The second attack of fever was mild.

19,626. Did you have headache then?—I had a chill.

19,627. Any vomiting?—No.

19,628. Did you have fever on the third occasion?—I went to the funeral ceremony of my brother, and afterwards I went to the tank and had a bath. I felt chilly there and I came home.

(*Dr. Ruffer.*) Is there anything to see under your axilla? Have you still got the scar? (*The Commissioner here examined the axilla of the witness.*) I see the scar is about half-an-inch long on the outer border of the *pectoralis major* muscle: it is not in the axilla.

(Witness withdrew.)

Mr. G. Monteath, I.C.S.

Mr. G. MONTEATH, I.C.S., called and examined.

19,629. (*The President.*) You are in the Indian Civil Service, and are Assistant Collector at Thana?—Yes.

19,630. (*Mr. Cumine.*) In what districts have you had experience of plague, and for what periods in each?—In Satara for six or seven months, and in Thana since June last.

19,631. In your précis of evidence you mentioned the town of Tasgaon. At first, was your evacuation confined to the infected houses, and those immediately surrounding them?—Yes, it was.

19,632. Did you find that that stopped the spread of plague in the town?—Not at once.

19,633. What did you go on to evacuate?—The whole of the infected quarters, by pets and blocks.

19,634. Did that stop the spread of plague in the town?—It did, in a little less than three months.

19,635. Why did you have finally to resort to complete evacuation of the whole town?—The town was never completely evacuated.

19,636. When there were fewest people in the town, about how many were there left?—Under 1,000.

19,637. As regards the infected villages, did you have some instances where, having got the first one or two cases, partial evacuation was successful in preventing the spread of plague in the village?—Yes, I remember two cases.

19,638. But in the majority of cases did it fail?—In the majority of cases the plague was not found out immediately on the first case occurring, and so partial evacuation failed.

19,639. In order to make evacuation produce the maximum of good, with what other measures must it be supplemented?—First, I think you must separate the sick, and also the inhabitants of the same houses, from the healthy population.

19,640. That would be one measure; what is the other?—And disinfect the houses themselves.

19,641. And prevent communication with the infected houses?—Yes, as far as possible.

19,642. If in a district there are a large number of villages infected, is it practicable for the Collector and his staff to effectively carry out, in the case of each village, the measure of evacuation with the two or three complementary measures that you have mentioned?—I do not think so, judging from the Satara district, unless all the village officers are to be depended on.

19,643. Have you anything to tell us, in connection with monkeys, as to the way in which the poison hangs about evacuated houses?—I give the instance for what it is worth. When the village was evacuated, large numbers of monkeys used to enter the houses by the gaps made in the roofs, seeking what they could steal I noticed, on riding into the village on one occasion, a monkey drop dead from a tree above the chavdi. On inquiry I learned that 10 or 12 had died similarly—some in the houses. Coming again to the village a few days later, I was told that five or six more had died.

19,644. Did you have any of them bacteriologically examined?—No.

19,645. You mention, in your précis of evidence, Parli Fort as a good instance of the way in which rats helped to spread the disease. Do you mean spread the disease from house to house within a village?—Yes, from house to house.

19,646. How do you know it was rats that were spreading it from house to house?—I went up there and found out for myself.

19,647. How did you satisfy yourself that it was rats?—I saw one or two, and all the people agreed that rats were dying in nearly every house in the Fort. It is a very confined place, of course.

19,648. I ask how you knew it was rats that were carrying it from house to house?—I think it was by rats, but I did not prove it.

19,649. Have you any notes to show how long after the arrival of an imported case, which infects the village, the first indigenous attack occurs?—I have no notes; but I remember that, in Vasadage, it seemed to take about 14 days.

19,650. Have you noticed whether rats are, or are not, always attacked between the imported case and the first indigenous case?—Yes, I think that is almost always so, according to what I have seen.

19,651. Would the imported case appear to infect the local person directly, or would it appear to infect the rats first, and then the rats infect the local person?—It seemed to me that it infected the rats indirectly, and then they spread the disease from house to house. I do not know, but that is what it seemed to me.

19,652. Do you think you quite understand my point? We have been told by one witness that there always appear to be attacks amongst rats between the imported case and the first indigenous case, as though the imported case were unable to infect the local people directly, but had to do it through the medium of rats. Have you noticed that at all?—I have noticed it, yes.

19,653. That rats always died between the imported case and the first local case? Can you say confidently that you have noticed that?—I have noticed that they almost always so die.

19,654. Would you read us what you say in your précis about Wasind?—Wasind, taluka Shahapur, was infected about August 20th, 1898. Fortunately the village was

discovered to be infected before the first indigenous case occurred, from the fact that rats had begun to die in several houses. A good many persons left the village of their own accord, and on the occurrence of the first case the whole of the inhabitants of the infected area (the bazar) were made to go and live in the fields. Two or three cases occurred among the railway hands, whose families lived in the bazar. The disease died out almost at once. In November a solitary case, apparently of plague, occurred at Wasind; the same measures were put in force, and there were no more cases. One case was reported on December 9th, but I do not believe it was plague, since it was neither preceded nor followed by other cases, nor by the discovery of dead rats.

19,655. Who said that the case on December the 9th was plague?—It was reported to me by the Mamlatdar as plague.

19,656. Since one case in November, and one case in December, appear to have occurred, would you say that the outbreak of August the 20th had died out, or that it appeared to be smouldering?—I think it had died out, there have been no more cases since.

19,657. Is there any plague in Wasind now?—No.

19,658. Has the death rate of Wasind been abnormally high lately?—No.

19,659. Is there any plague in Kalyan at present?—Yes, there is.

19,660. Has the segregation of contacts been abandoned in Kalyan?—Yes.

19,661. What has been the effect of that?—What happened immediately afterwards was that the number of cases a day were nearly doubled.

19,662. And then?—And then in about a fortnight they decreased again.

19,663. Do you leave any of the patients in their houses in Kalyan, if so, which?—Cases occurring among persons who pay Rs. 20 and more income tax are allowed to be segregated in their own houses, one or two members of the family remaining to attend the sick person, and the rest being directed to remove either to another house or out of the town.

19,664. Do you disinfect daily these rooms in which the patients are?—No.

19,665. You find that bad results have arisen from leaving the patients in their houses?—Directly or indirectly, altogether. The rest of the people want to follow their example, and it is rather difficult to deal with them.

19,666. Do you find that many other people have been infected by these patients?—No, I cannot say so.

19,667. Do you find that the people left to nurse them get plague a good deal from them?—I do not think so, anymore than they would if they were turned out.

19,668. Have you had any experience of inoculation?—No, none at all.

19,669. Has any instance come to your notice of plague having appeared in a village which was infected last year, and which has had, so far as you can make out, no fresh infection this year? Has, in fact, any instance of a real recrudescence, from the original germ, come to your notice?—Which was not re-infected this year?

19,670. Quite so?—I do not remember any.

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19,671. Did you allow these patients in Kalyan that you left in their rooms to be put on a bed, or did you allow them to lie on the floor?—They mostly had beds.

19,672. If they have not, do you put them on a bed?—No.

19,673. (*Mr. Hewett.*) Have you tried the kiln system of disinfection at all?—Dr. Dadima has tried it in Kalyan.

19,674. Is it expensive?—No, not as it is done.

19,675. Do you think, supposing that disinfection with perchloride of mercury is equally effective, that it is preferable to the kiln systems that are substituted for it?—I do not know, but I have seen no results from the kiln system.

19,676. Supposing they were equally effective, which would you prefer?—I think the kiln system would be better and cheaper probably.

19,677. You think it would be cheaper. Do you think that it would involve less interference with the people than disinfection by means of perchloride of mercury?—No, I do not think it would.

19,678. Do you think that it would interfere more with them?—Yes, I do, somewhat more.

19,679. You tried burning down huts once or twice, did you not?—Yes, I did twice.

19,680. Were they isolated huts?—They were.

19,681. People would not like that to be done on a large scale?—They would not.

19,682. Did you find it effective in the cases where you burnt them down?—I did in those two instances.

19,683. Had you a single case in each hut?—Yes, a single case.

19,684. (*The President.*) What do you think, in your experience, is the most effective method of dealing with an epidemic of plague?—The most effective seems to be to turn all the people out, or as many of them as possible, into the fields.

19,685. Evacuation?—Yes.

19,686. What is the largest town or village in which you carried out that method?—Kalyan, I suppose; it is practically evacuated.

19,687. What is its population?—The normal population would be about 13,000.

19,688. Within what time did you effect the evacuation of the town, how long did it take?—It took about three months, gradually.

19,689. You did not try to do it all at once?—No.

19,690. What is the kind of house in the district you are now talking about?—In the villages most of them live in very poor huts—chappars.

19,691. How many chambers in each hut?—Sometimes two, sometimes three; they are only separated by chappar.

19,692. What outside openings have they got besides the door—have they any windows?—No, no windows.

19,693. Only a door?—Yes, only a door, or doors.

(Witness withdrew.)

Lieut.-Colonel A. W. F. Street, I.M.S., called and examined.

Lt.-Col. A.W.F. Street, I.M.S.

19,694. (*The President.*) You are in the Indian Medical Service and Sanitary Commissioner for the Presidency of Bombay and Sind?—Yes.

19,695. What are your medical qualifications?—M.R.C.S.E., and L.R.C.P.Lond.

19,696. (*Mr. Hewett.*) Can you give us the total mortality from plague, and the rate per mille per annum, first in Bombay, and secondly, in other parts of the Bombay Presidency and Sind, from 1896 to the present time, also the mortality from all causes at the same time and the rate per mille; also the mortality from cholera and the rate per mille; and also the mortality in all diseases classified as fever?—I put in a statement which gives the figures asked for.*

19,697. Have you any Assistant Surgeons employed under you in the Sanitary Department in the Bombay Presidency?—There is only one Assistant Surgeon in the Department, but he has no sanitary duties.

19,698. How many Deputy Sanitary Commissioners have you got?—Five.

19,699. Does a Civil Surgeon in the Bombay Presidency and Sind have any authority as regards sanitary matters?—Not any real authority; in his own town he interests himself to a certain extent.

19,700. Has he any responsibility as regards th sanitation of the Municipalities in his district?—No, do not think so, except in places where there are dispensaries, and in his headquarter station.

19,701. Nor as regards the sanitation of rural areas in his district?—No, none.

* *See* App. No. LVII. in this Volume.

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19,702. The whole responsibility as regards the rural areas at all events rests with the peripatetic officers; the Deputy Sanitary Commissioners, and you?—Yes.

19,703. Are you Inspector-General of Vaccination, as well as Sanitary Commissioner?—Yes, vaccination is one of the duties of the Sanitary Commissioners.

19,704. Have you any establishment as Sanitary Commissioner, distinct from the establishment which you have as Inspector-General of Vaccination?—Only clerks.

19,705. What is your vaccination establishment?—Inspectors and vaccinators. The Inspectors of Vaccination are Inspectors of Sanitation as well.

19,706. What is the number of vaccinators employed under you?—388.

19,707. And of Inspectors of Vaccination?—One Superintendent of Vaccination, Bombay, one Superintendent of Vaccination, Karachi, one Assistant Superintendent, Bombay, 31 Inspectors of Sanitation and Vaccination.

19,708. You say these Inspectors are employed on sanitary matters?—To a certain extent.

19,709. Have they any sanitary qualifications?—No, no qualifications; no pass qualifications. They pick up a certain amount of knowledge when with the Deputies on tour.

19,710. They have not been trained in hygiene?—No.

19,711. What is the rate of their pay?—Rs. 55, 75, 100, and including travelling allowances Rs. 75, 100, 130.

19,712. Are any of them Assistant Surgeons?—No, except the one in Bombay, who has no sanitary duties, and he gets Rs. 380 pay and allowance.

19,713. Would it in your opinion be a good plan to substitute for your present Inspectors of Vaccination, Assistant Surgeons who have been trained in hygiene?—Do you mean in order to benefit vaccination?

19,714. I mean in order to benefit sanitation?—Yes, of course, but I do not know whether vaccination would be benefited.

19,715. Why do you think vaccination would not benefit?—Because I like the men who have gone through the mill and risen from vaccinators.

19,716. On what ground?—Because they know all the ins and outs of the work.

19,717. Do you think that an Assistant Surgeon could learn the ins and outs of vaccination?—I do not think he could as well, not unless he went through the mill himself.

19,718. Has the Inspector been through the mill?—Yes.

19,719. Could not the Assistant Surgeon acquire the necessary knowledge?—Yes. I do not doubt, if you got very good men, he might.

19,720. Can you suggest any means by which you can obtain earlier notification of cases of plague other than the improvement of the class of your subordinates?—Of course we have the village officers.

19,721. Do you think that the responsibility of the village officers is one which can ever be properly enforced? Can they know what is plague and what is not?—That is so.

19,722. Can you suggest any other means of improving the system of notification?—You cannot supervise every village with a fully qualified man in that way.

19,723. My idea was that a qualified Assistant Surgeon might, while on inspection work, be able to help you to some extent if he had to look round and inspect the village and examine its condition from a sanitary point of view; might he not assist you as regards the recognition of plague?—He might, but the villages are very numerous, and he would have a large number of villages. My vaccinators have done a little in that way. They have always been told, if they come across anything of that kind, to report it.

19,724. Is their utility in this respect not rather affected by the fact that they could not tell a case of plague?—Yes; but if the village officers knew that plague was in the village, and the vaccinator went there, they would not let him work, and would tell him that there was plague, and, therefore, he could not work, and then if plague was being concealed, its existence would come out.

19,725. You think that you could, under present arrangements, find out the existence of plague in places where it exists to a considerable extent?—Yes.

19,726. I was thinking more of trying to find the first cases?—That would be a very big business owing to the extent of the country and the number of villages.

19,727. I do not quite understand why an Assistant Surgeon, who had been properly trained, should not be able to check the ordinary vaccinators in their work?—I do not see why he should not, if we got good men; but I prefer a man who has gone through it all from being a vaccinator.

19,728. Have you any authority as Sanitary Commissioner over the city of Bombay?—No, except as regards vaccination, and to a certain extent, over the Health Officers of the Port.

19,729. (*Dr. Ruffer.*) Who appoints the Deputy Sanitary Commissioners?—Government appoints them, but there are generally candidates for the post, and the Sanitary Commissioner would choose and recommend a man to the Government.

19,730. Are they chosen from men who have got special qualifications in sanitary affairs?—I do not know. I suppose a man would be preferred if he had.

19,731. As a rule they are not?—I cannot say absolutely.

19,732. Have you got a voice in their choice?—Yes, I think so. If I knew a man I wanted, I should ask for him; and if a man wanted an appointment he would write to me and say he wanted to come to the Sanitary Department, and I would pick out the best man, and ask for him if there is a vacancy.

19,733. You have five Deputy Sanitary Commissioners?—Yes.

19,734. How many of the Deputy Sanitary Commissioners have any qualification in Sanitary Science?—I know one has; I do not think any of the others have.

19,735. What qualification has he got?—D.P.H.

19,736. Of Cambridge?—I think so; I am not sure.

19,737. Have you any authority over Civil Surgeons?—No, none.

19,738. How large is the District the Deputy Sanitary Commissioner has to visit?—I have only just taken up the office of Sanitary Commissioner. I have been a Deputy for years.

19,739. How large is your district?—It is as big as Scotland.

19,740. How often do you visit each village?—I could not visit each village.

19,741. You have never visited each village?—No. I have got five Collectorates, and they are divided into talukas, and it is as much as I can do to visit half my talukas in one year. I ought to have only half the district, if I had to visit each taluka. The average number of villages in one taluka is 154; the numbers range from 49 to 394.

19,742. The large majority of the villages are not visited from year to year by a Sanitary Commissioner, or a Deputy Sanitary Commissioner, or anyone holding a Sanitary qualification?—A very very small proportion. Of course the Inspectors visit a fair amount.

19,743. I believe there is a Provincial Sanitary Board?—Yes.

19,744. How often does that meet?—I cannot say; I have just taken over the duties.

19,745. How long have you been Sanitary Commissioner?—About a month.

19,746. Has it met during that time?—No.

19,747. Can you tell me how many formal meetings they have had in the last three years, and whether minutes were taken?—During the monsoon, once a week, or oftener if there is anything urgent. During the fair season, perhaps, once a month. No minutes are kept as the Board has no initiative, and is, therefore, only a consultative body to consider plans and proposals transmitted to it by Government and others.

19,748. Have you any disinfecting apparatus in Bombay apart from the plague work?—No.

19,749. None whatever?—No, not that I know of.

19,750. Have you any disinfecting arrangements at all for other diseases besides plague?—No, I do not think so. When the plague began, I do not think there was

a single disinfecting machine in Bombay, so far as I remember.

19,751. What are the number of villages the vaccinator goes through in the course of the year?—I generally like to give them about 80.

19,752. How often does he get into these 80 villages, once or twice?—Every one once, and the big ones twice, as many as he can of the big ones.

19,753. (*Mr. Cumine.*) Did you tell us how many Sanitary Inspectors you had? Take the district of Ahmednagar; how many are there in that district?—One to each Collectorate; I have got two in Satara.

19,754. In one Collectorate, how many hundred villages would there be?—A very very large number, 403 to 2,824.

19,755. (*Prof. Wright.*) How many members are there on the Sanitary Board?—Two members; the Sanitary Commissioner and the Sanitary Engineer.

19,756. Have you any other work beyond inspecting vaccination?—Sanitary work and vaccination.

19,757. What does the Sanitary work consist of, reporting on accumulations of dirt?—Inspecting the Municipal towns. The Sanitary Commissioner confines himself to the Municipal towns. The Deputies go everywhere.

19,758. What does the Sanitary Commissioner do?—You inspect a town and see what they have and what they want, what can be improved; and then you put it on paper in the form of a report.

19,759. Supposing there is an epidemic of cholera, do you take any practical measures, or do you simply write a report?—In most large towns, where you do anything, there would be a Municipality most likely, and they are put into motion. There would be a Civil Surgeon most likely.

19,760. Has the Sanitary Department anything to do with fighting cholera in a cholera epidemic, for instance?—It does what it can. You cannot do much except in the large towns. For the country we try to improve sanitary matters by a better water supply and that sort of thing. That is the only way to get over cholera in the districts.

19,761. There is a good deal of inspecting; but is there any practical action taken?—It is difficult to get any action taken. It is generally through want of funds.

19,762. Do you think the inspection does any good, short of taking practical steps as the result of that inspection?—Yes, it does a certain amount of good. It keeps Municipalities up to their work, and you may get some improvements even if there is no money to do it with, and then when the time comes you have got it down on record what is to be done. You can advise the Municipality what they ought to do, and when they get money they may spend a certain amount in the necessary improvements; and when they get more they may turn their hands to the other things.

19,763. I see the expenditure of the State upon the Sanitary Department: I do not see the return that accrues to the State, except in the case of vaccination?—If they give us money we are prepared to do more.

19,764. (*The President.*) What are the chief duties of the Deputy Sanitary Commissioner?—Vaccination and sanitation.

19,765. How much of the time is occupied in vaccination work?—The seven months that he can get out he travels in the districts and inspects. He does vaccination and sanitation work at the same time.

19,766. The chief work is vaccination?—Yes, we have money for it and we do it.

19,767. It is a sort of incident to his work that he does sanitary work?—There are certain sanitary duties to do when he is on tour. Every village I go to I see the water supply and that kind of thing; and in every Municipality I make a thorough inspection,

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19,768. Do you go into the houses to see what the actual conditions in the houses are, or take any cognisance of overcrowding or ventilation?—No; not, as a rule, in the country, but we do in the towns, when necessary. We know what the conditions are.

19,769. Any cognisance into the conditions of milk supply?—I am speaking of the country now.

19,770. Any part of your district—country or town?—In the towns we do, but to a very limited extent, and only, as a rule, in the case of European supplies.

19,771. I thought you said the amount of vaccination work was so large that it practically occupies the whole time?—You have to go a certain number of miles to a village, and when you are there you can do both. If I had to go 20 miles in one direction to see sanitation, then 20 miles in another to see vaccination, it would take a lot of time, but I can do both in the same village.

19,772. What do you mean by both? You mean with regard to large questions like those of water supply?—Yes, water supply, the surface cleanliness, and surface drainage. Those are the things we chiefly want in villages, good water supplies and good wells.

19,773. I did not quite gather how long it took you, when you were Deputy, to go round your own district?—Two years. I could hardly do it in two years.

19,774. Did you visit every village of a fair size in two years?—No.

19,775. How long would that take you?—I could not do it.

19,776. Ten or 20 years?—Yes.

19,777. With regard to the Inspectors, who have smaller areas to deal with, what are they termed—what is their official title?—Inspectors of Sanitation and Vaccination.

19,778. Do they merely inspect the vaccination, or do they themselves vaccinate?—They inspect.

19,779. In regard to the work of vaccination, how often can they go through and inspect the district which they have to deal with?—They go through every part of it once a year or more.

19,780. It requires very nearly a year to inspect the vaccination of that area?—Yes.

19,781. Then there cannot be very much time left for examining the details of the sanitary conditions, I presume?—No; except, as I say, you can combine the work. I mean if you are in one place, your vaccination does not take you the whole day. You can do your vaccination work, and then you can do your sanitation work in the village. The distances are so great that the work must be combined.

19,782. (*Mr. Hewett.*) You have not mentioned anything with regard to vital statistics. Is it not a part of the duties of the Sanitary Commissioner and Deputy Sanitary Commissioner to supervise the collection of vital statistics?—We register all the births and deaths.

19,783. Do not you go round and check the correctness of the registers?—Yes.

19,784. Is not that one of the most important duties of your inspecting staff?—Yes, it is one.

19,785. Then you are not entirely occupied in vaccination?—Oh no, that is another part of it. They do that in the villages they go to: they examine, in fact, all the registers, the sanitary registers, the vaccination registers, and the cholera registers.

19,786. (*Mr. Cumine.*) You were asked by Professor Wright what share the Sanitary Department take in fighting an epidemic. Do they take any share at all in the actual fighting of it when it breaks out?—It depends; if it is a big Municipality they do.

(Witness withdrew.)

Lieutenant H. P. KEELAN, I.S.C., called and examined.

Lieut. H. P. Keelan, I.S.C.

19,787. (*The President.*) I believe you are a member of the Indian Staff Corps?—Yes.

19,788. And you were engaged in plague work in Hubli?—Yes.

19,789. (*Mr. Hewett.*) Could you state the dates between which you were employed at Hubli?—From the 25th of December 1897 to the 10th of October 1898. From the 10th of October 1898 to the 11th of November 1898 I was in Dharwar, a few miles from Hubli.

19,790. What is the normal population of Hubli?—About 55,000.

19,791. At the time you went there in December was there any plague?—There had been some cases in the railway chawls before we arrived there; and for about,

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I think, 25 days at a time, we used to find one solitary case now and again. There was not plague really for the first month after I arrived there.

19,792. What duties were you employed on first?—I was first employed in the railway station, disinfecting passengers.

19,793. When did plague actually begin to attract your attention in the town of Hubli?—About April, I think.

19,794. What measures did you take when it broke out in the town in April?—We had the ward system going on the whole time before that.

19,795. That is a system by which you hoped to discover cases, is it not?—Yes.

19,796. Please describe the system?—The city was divided into ten sub-divisions, and each sub-division was divided into wards. Each ward had a certain number of Ward Supervisors, and there were Ward Superintendents over the Ward Supervisors.

19,797. How many houses had each Ward Supervisor to look after?—From about 90 to 120.

19,798. How many Supervisors had the Ward Superintendents to look after?—About 10. They were not alequal. There were 10 in some, and 11 in others, and so on.

19,799. Did this arrangement give accurate and immediate reports of all cases of sickness?—As far as we could make out it did at the beginning, when the cases were few.

19,800. You think that you found the first case that occurred in Hubli?—I was not there when the first case occurred.

19,801. Do you think you found the first case that occurred when plague began for the second time in April?—That I cannot tell. I am doubtful about that myself.

19,802. When did the system cease to work satisfactorily?—When the panic set in.

19,803. When did the panic take place?—About May, when the cases began to increase. During the rains, generally, it went up. In May, June, and July the panic kept on increasing.

19,804. When you heard of a case of plague, did you remove the sick person out of his house?—Yes.

19,805. What did you do with the healthy persons residing in the house?—We segregated them.

19,806. How many camps had you?—Two camps.

19,807. How many people were in these camps at any one time?—We have had as many as 2,500. It was a bad time of the year.

19,808. What was the maximum you had in your camps at any one time?—Over 2,000. I was not running it myself.

19,809. Who was running it?—Dr. Leumann.

19,810. Did many of the people leave the town?—Yes.

19,811. In what months did they leave the town?—I think it was in July and August.

19,812. Had you a system of issuing passes before they left the town?—Yes.

19,813. When was that introduced?—From the time of my arrival there they had a system of passes.

19,814. Did you give passes to people who went by road as well as by rail?—Yes; but there was no check upon that at all.

19,815. Would any individual who came to you and asked for a pass be entitled to get it?—At first he was, if we knew if he lived in a fairly healthy locality where there had been no plague.

19,816. When did the system change?—The system was changed when inoculation came in.

19,817. Do you remember when that was?—I could not tell you exactly when that was.

19,818. After inoculation came in you only gave the certificates to persons who had been inoculated?—Yes.

19,819. Was it necessary that they should have been inoculated more than once in order to obtain a certificate? — As a rule the people were twice inoculated.

19,820. Were you then responsible for giving the certificates to the twice inoculated who went away by road?—Yes.

19,821. Do you think that the people continued to leave by road after this rule was introduced with regard to inoculation?—Yes.

19,822. Do you consider that as many of the inoculated left as of the uninoculated persons?—No. We found that out by asking our Ward Supervisors to send in lists of the number of persons inoculated, and the number of persons uninoculated every week.

19,823. Then you think that more uninoculated persons left than inoculated?—Yes.

19,824. In spite of the fact of your system of passes?—Yes.

19,825. Then the system of passes was practically useless?—Yes, as far as the road was concerned.

19,826. Were there persons who had been twice inoculated, and who were allowed to remain in their houses when plague occurred in them?—Yes.

19,827. What did you do to the houses in those cases?—We had them disinfected and put back those people who were taken out for the time being.

19,828. Leaving the patient in the house?—No; the patient was taken away to hospital.

19,829. Did you collect any figures to show that in these cases the inhabitants of the houses were not attacked by plague?—I collected particulars of about 200 cases where the uninoculated were attacked, and the inoculated were left in the town and got off.

19,830. Were the figures which were attached to Captain Leumann's Report,*—the 69 cases in the appendix—collected by you?—Yes, the majority of them; more than that, I collected about 200 cases.

19,831. Did you personally verify in each instance the names of the persons said to be inoculated?—Yes.

19,832. And the names of the persons said to have died from plague?—Yes. I went to the houses and asked them all to show their passes.

19,833. What I mean to say is this: supposing you went to house No. 744, did you test whether the five individuals who were said to have been inoculated and to have escaped plague were then present, and whether they had been actually inoculated?—Yes. I took away all the passes, and asked them their names separately.

19,834. Did the deaths from plague come to your notice in the ordinary business of plague administration?—Yes.

19,835. Then are you responsible for the accuracy of the Appendix of Captain Leumann's Report?—Some of the cases were got by him, but the majority were got by me; I do not know whether he has got mine or his.

19,836. Did you find that cases of plague were notified mainly before or after death?—Mainly after death.

19,837. When you had a case notified to you after death, how did you determine whether it was the body of an inoculated or uninoculated person?—We went to the house and simply asked if the person had been inoculated.

19,838. Supposing the residents said that he had not been inoculated, did you accept the statement?—The person's name was sent in, and Dr. Leumann proved whether the person had been inoculated or not in his records.

19,839. Did the records contain the the place of residence of each person inoculated as well as his name?—Yes.

19,840. Was Dr. Cardoz employed in the identification of bodies?—No.

19,841. Did you take the original census of Hubli?—No.

19,842. By whom was it taken?—It was taken before my time.

19,843. Were you responsible for ascertaining through the Superintendents how many persons arrived in Hubli and departed from Hubli each week?—Yes.

19,844. Did you then deduct from your assumed population the number of deaths and the number of persons who had departed, and add to it the number of persons who were reported to have arrived?—Yes.

* *Vide* App. No. XV. in the first Volume of the Commission's Proceedings.

They were not exactly accurate always. There was generally a discrepancy of one or two in each ward.

19,845. Do you think that the result was approximately accurate?—Yes.

19,846. Assuming that the original census figure was right?—Yes.

19,847. Do you rember any date from which a difference was made in recording the number of deaths of plague among the once inoculated?—No. I always put down whether they had been once inoculated or not. The people in the houses generally told me.

19,848. Do you think that cases of deaths from plague among the inoculated were actually recorded as having occurred amongst the uninoculated?—Yes, I think so; there may have been a few left out. I know for certain that some had gone away and died, because they were brought in sometimes, and we got accounts. But the inoculated almost all stopped in Hubli.

19,849. The assumed population of Hubli at the beginning was 58,000, and by the 13th September 1898 it had fallen to 38,408. Of that 38,408 what number do you think had been inoculted?—I should have said by the figures I had then that there were about 3,000 or 4,000 who had not been inoculated.

19,850. Do you continue to hold that opinion?—Yes.

19,851. You do not think there were more than that?—No.

19,852. When you were at Dharwar what privileges were given to the inoculated?—They were given passes. They were allowed to stay in the houses, just the same as in Hubli.

19,853. Notwithstanding permission to stay in their houses, did not a large proportion of the population of Dharwar run away?—They evacuated their houses and lived outside.

19,854. Do you mean that they left the town of Dharwar and that you did not know where they had gone to?—They would be in big camps round Dharwar.

19,855. About how many people were there in those big camps?—I should think in one of the camps there were 400 or 500 people.

19,856. Could you estimate the total population which you think might have been in those camps?—There were huts and camps all over the place, all round Dharwar.

19,857. Do you think there were 10,000 altogether?—Quite.

19,858. Do you think there were more?—I could not tell you that, but I should think there were quite 10,000 people.

19,859. How many were there left in Dharwar town?—I do not remember. I know that a great many went away by train when the first case or two occurred; they went through Hubli by train when there were no restrictions whatever on Dharwar.

19,860. Did a considerable number of inoculated people leave Dharwar?—Yes, they did.

19,861. Did more uninoculated people leave Dharwar than inoculated?—We never tested that.

19,862. You did not test it as you did in Hubli?—No.

19,863. Do you think that more uninoculated people went?—I think about an equal proportion of each. They simply went out into their huts outside, and used to come in from there to be inoculated.

19,864. Do you know how the uninoculated people got back into their houses in Dharwar?—I think they had huts outside and used to come in and sleep at night.

19,865. But when they went away you used to lock their houses up, did not you?—No, we did not.

19,866. You were not there when the houses were locked?—I was there in October and November.

19,867. The houses were locked when we were there?—They locked the houses themselves. There was a rule that the people must be twice inoculated before they were allowed to return to their houses.

19,868. How could you prevent them going back if they themselves had locked their houses?—The Ward Supervisor would go round every morning, and if he learned that a family had come back who were uninoculated, those people would either have to go to the health camp or else be turned out again.

19,869. How long was that rule in force?—From the beginning of plague there.

19,870. (*Dr. Buffer.*) I do not quite understand how your census was taken. Did the Ward Supervisor go round all the houses each week and ascertain the number of people?—Yes; every Sunday morning he went round. That is the day we thought most people would be in because all the cotton mills and workshops were closed. A lot of people in the railway workshops lived in the town.

19,871. How did you ascertain the number of people? Did you get all the people out in the street and see them?—That was the order given.

19,872. Did the Supervisor do it?—I cannot say that, but it has been done in some cases. I used to go round some of the wards during the week.

19,873. Did you find that the previous statements of the Ward Supervisor were correct when you yourself went with him, or did you find any marked discrepancy?—There was never any marked discrepancy.

19,874. Supposing an inoculated person died, was the house treated in the same manner as when a non-inoculated person had died?—So far as disinfection was concerned it was treated in the same way, but otherwise the people were taken out of the houses and put back again.

19,875. The inoculated people?—Yes.

19,876. What was done with the uninoculated people in the same house?—They were taken to the segregation camp.

19,877. (*Mr. Cumins.*) Does this Appendix* take in all the houses in which inoculated and uninoculated people lived together, and in which plague cases occurred?—No, there are only 69 cases there, I think.

19,878. On what principle were those particular houses selected?—I was told to get good cases, houses where several had been inoculated, and one or two had not been inoculated. There were a lot of houses where perhaps one person had not been inoculated and the others had, and those I should call good cases, where only one of the uninoculated got the disease. I could not go round to see every case when they got heavy.

19,879. I want to know why you went to these particular houses?—Because they came in my beat. I used to take a division one day, and in other cases I would ask the Superintendant to report to me, and I would go and verify it.

19,880. Did you ever see the register kept of inoculated persons?—No, it was kept in the Plague Hospital.

19,881. You do not know whether the names and addresses of each individual were got down fully?—The Pet was put down.

19,882. Have you ever seen the inoculation process going on at the busiest time?—Yes.

19,883. How many people were done in one minute?—I should think about 2.

19,884. When you were making inquiries from house to house as to attacks among the inoculated and the uninoculated, and certain people came forward with inoculation certificates, saying that they were inoculated people who had escaped, did you make any endeavour to make certain as regards each person producing such a certificate that he was really the person named in the certificate?—My method was to take all passes away from the people. A certain number of people showed me their passes, and I asked each one what his or her name was. Then if the name given corresponded with the name on the certificate I gave it back.

19,885. Did you make any endeavour to find out whether the person was giving the correct name or a false name?—I do not see how they could find out what names were on the passes.

19,886. But did you make any endeavour?—No, the inoculation certificates were all written in English.

19,887. Supposing a person has a certificate and dies, and his brother annexes the pass, would he not know that his brother's name was on the pass?—Yes, he would. There is no way of ascertaining that.

19,888. (*Prof. Wright.*) What were the inducements offered to people to get inoculated?—The inducements were, that in case of plague occurring in the house, the inoculated persons would not be segregated or sent

* Vide App. No. XV. in the first volume.

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to the health camp. Also, in case of an area being turned out, inoculated persons would not be sent to either of those camps. They could also travel anywhere in the district with a pass, whereas people who were uninoculated would not be given a pass.

19,889. Do you think that the people felt that there was any pressure being applied?—At first they did.

19,890. Do you think, therefore, that uninoculated people would have tried to escape observation? For instance, would they have gone out by the back door when the census was taken and try to hide themselves?—Yes, they did.

19,891. How do you explain the enormous mortality of 65 per cent. there was in certain weeks among the uninoculated? Do you think that represents the actual mortality among them, or do you think there were more uninoculated people than was stated in the returns?—There may have been a few more uninoculated, but I do not think there were many more. I think that this census which was sent in was really correct for each division to within 50 or 100.

19,892. You think there was actually that enormous mortality among the uninoculated in those particular weeks?—Yes.

19,893. I undertand that the total mortality among the uninoculated was 14 per cent., while some weeks it rose to 65 per cent.?—Yes.

19,894. Can you account for that in any way?—No, I cannot. The only thing is, that plague got into a bad quarter where the people were not inoculated. It got into the Muhammadan quarter and carried them off right and left. The plague seemed to go from north to south, it started near the railway workshops, and went straight down to the south of the town. When it got to the congested quarters it took off more people.

19,895. You think the excessive mortality during those particular weeks may be accounted for by the fact that plague had spread into the densely populated and uninoculated quarters?—Yes, I think so. I cannot put any other construction upon it.

19,896. Do you know, as a matter of fact, of the existence of any such uninoculated areas in Hubli?—Yes, there were one or two uninoculated areas where people were most loth to come up for inoculation, but they gradually came up afterwards. I do not know what time the plague was there.

19,897. Can you suggest any means of finding out whether an excess of mortality occurred in those particular areas in those particular weeks?—The returns would show. I suppose they have got the returns in Hubli showing the number of deaths in each of those wards.

19,898. (*Dr. Ruffer.*) Did I understand you to say that the population of Hubli was 55,000?—When I arrived there I think the population, according to the last census, was 52,000, and I estimated there were about 3,000 more people since the census had been taken.

19,899. (*Mr. Cumine.*) With regard to the principle on which you selected those 69 houses, you said you took them because they were good cases?—Yes.

19,900. Do you mean good cases as showing the protective power of inoculation?—Yes. If I went to a house and saw that none of the people had been inoculated, and a person had died, I would not call that a good case. I had lots of cases where there was one person inoculated and four or five uninoculated in the same house, and an uninoculated person died there. I did not think so much of that case as I did where 10 persons were inoculated and the 11th was uninoculated, and the uninoculated person died.

19,901. Did you enter in this statement any cases where, there being both inoculated and uninoculated in a house, it was an inoculated person who was attacked, and all the uninoculated persons escaped?—All the time I was there I got three cases where every person in the house had been inoculated and one of them got the plague.

19,902. That is not my question. Have you got in this statement any house in which, there being both inoculated and uninoculated people, all the uninoculated escaped, and one or more of the inoculated people were attacked?—No.

19,903. Can you say that no such houses existed?—None came to my notice.

19,904. It is not the case that you rejected such cases and entered only those favourable to inoculation?—No.

19,905. When you had prepared this statement, who compared the names in it with the names in the inoculated register in the possession of the Inoculating Officer?—Dr. Leumann, I presume.

19,906. You did not?—I did not. Is imply sent in the cases with the number of the pass and the date on which the man was inoculated. They were sent to Dr. Leumann, and he selected them out of about 200 cases which I sent.

19,907. When a man did not produce a pass, did you assume he was uninoculated?—Yes.

19,908. Did you ever find cases where it was declared that a man had been inoculated, but where he had no pass to produce?—Very seldom. The people looked after the passes far too well.

19,909. When you did find such a case, did you return it as inoculated or uninoculated?—Uninoculated, if I did not see any pass. If they did not show me a pass I presumed they had not been inoculated, and I sent them either to the health camp or the segregation camp.

19,910. You had no extract from the inoculation register which is in the possession of the Inoculating Officer?—No.

19,911. You cannot tell us whether the entry in the inoculation register was so full as to enable you to identify the person entered?—No.

19,912. You cannot tell us whether it was a full entry or not, whether it gave the man's name and stated that he lived in such and such a house in such and such a street?—I cannot tell you that.

(Witness withdrew.)

Dr. W. Venis.

Dr. W. VENIS called and examined.

19,913. (*The President.*) You are Divisional Health Officer of Bombay?—Yes.

19,914. Of what division?—No. 3.

19,915. What wards?—Byculla, Mazagaon, Tarwadi, Tardeo, Kamatipura, and 1st and 2nd Nagpada Sections.

19,916. (*Prof. Wright.*) You have had experience of corpse inspection in Poona?—Yes.

19,917. Is corpse inspection done in the houses after death?—Yes.

19,918. Was it never done at the cemeteries or burning ghats?—No.

19,919. Do you think it is better to do it in the house than at the cemetery?—Yes, because if it turns out to be a case of plague you know where the case occurred, as a rule.

19,920. Do the people object more to your doing it in the houses?—No, they do not object much in Poona.

19,921. Supposing the body was already dressed and prepared for burial when you arrived, was there any objection to allowing you to examine it?—In my own experience there were only objections on two, or, perhaps, three occasions.

19,922. Were you able to detect any other cases of plague besides the bubonic form by means of this corpse inspection?—In some cases we had a suspicion of pneumonic plague, but, of course, we could not be absolutely certain.

19,923. Do you think the system of discovering plague by corpse inspection is the best which can be adopted?—I think it is the best practicable means. It would be better if you could have all the cases notified and see them during life, but that is quite impossible.

19,924. Do you think that system would be applicable to a town like Bombay?—I should think probably not from what I have seen of Bombay.

19,925. What difference is there?—They are a different class of people; they are not so likely to be amenable to argument.

19,926. What do your duties consist of at present? Do you find out plague cases?—I have nothing to do with plague.

19,927. You are employed in the Health Department?—Yes.

19,928. Your only experience of plague is at Poona?—Yes.

19,929. Does your evidence bear upon anything else but evacuation and corpse inspection?—Simply corpse inspection and notification of illness. I was in charge of two of the camps at one time.

19,930. (*Dr. Ruffer.*) Were you ever able to examine the sick at Poona before they were removed from the house?—Yes.

19,931. How did you induce the people to let you see them?—There was no inducement required; they used to come and report the sick and the medical men used to report them.

19,932. Had they any objection to your seeing women?—No.

19,933. Did the Musalmans object at all?—Very rarely.

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19,934. In Poona, did you always examine corpses in the houses or sometimes in the cemetery?—Never at the cemetery. The body could not be removed from the house until we saw it.

19,935. Do you think they removed the body from one house to another?—I think they did occasionally from one room to another, but we used to disinfect the whole house, and it did not matter.

19,936. Did you disinfect the people?—They were sent to the segregation camp and detained there for ten days. On arrival in camp they were given a bath, and their clothes were disinfected. This routine was observed while plague prevailed in epidemic form. Later on close segregation was abolished and the people simply slept in the camp at night and went about their work during the day, but the disinfection of the persons and clothing of contacts continued as before.

19,937. Did they have mercurial baths?—Yes, perchloride of mercury. I forget the exact strength.

19,938. Did you ever get a case of mercurial poisoning?—Never.

19,939. Did you ever see a case of mercurial poisoning among the disinfectors?—Never.

(Witness withdrew.)

Major T. E. Dyson, I.M.S., called and examined.

Major T. E. Dyson, I.M.S.

19,940. (*The President.*) Where did you acquire your experience of plague?—I was first of all in Bulsar in the early months of 1897; afterwards, at the latter end of the year and the early part of 1898 I was in Surat.

19,941. What do you think is the manner in which plague is spread?—I think it is spread by human agency from place to place. In Bulsar plague was undoubtedly introduced from Bombay, and I think in Surat also, but I cannot speak positively about that. There are many people in Bulsar who have dealings in Bombay, and have houses in Bombay; they fled from Bombay in thousands, and the first cases occurred among them.

19,942. Having been imported, how did it spread, do you think?—I think it spread by human agency again and by rats into different parts of the town.

19,943. Have you any distinct evidence of its being spread by rats?—I have no distinct evidence that the rats died of plague; they were never examined, but there was an epidemic among rats as there was among human beings. There is a village close to Bulsar, where the first evidence of the existence of plague, preliminary to the outbreak among the people, was the death of rats in a particular quarter, while the people were not affected until afterwards. They promptly turned out of their houses and went into the fields to live, and developed plague a week afterwards among themselves.

19,944. Could they not have acquired plague by being infected by persons suffering plague?—They might have got it from Bulsar itself.

19,945. From human subjects?—Yes.

19,946. You have no more distinct evidence of the conveyance by rats?—No, not of the actual conveyance, but simply that in Bulsar itself large numbers of dead rats were found in quarters before plague appeared among the people, and also concurrently with cases among human beings.

19,947. When you got an imported case what steps did you take?—Unfortunately no steps were taken at all. The imported cases ran through their course to death or recovery before they were found out in the first instance. When they were detected they were removed to hospital, and at that time nothing was done to the rest of the inhabitants of the place.

19,948. Have you any opinion as to the length of time which elapses between the entrance of infection and the outbreak of an epidemic?—As far as I can judge in Bulsar it must have been six weeks, it may have been eight weeks. Of course, it is very difficult to know exactly. We have to take the time from the time when the cases were detected, or at any rate when there was an appreciable increase in the mortality. That occurred in Bulsar about the end of January.

19,949. But in the meantime, of course, plague cases may have been occurring?—Yes.

19,950. With regard to the treatment of an infected area, what did you find was the most successful measure?—I tried in Bulsar first of all cleaning and disinfection with lime. Afterwards, through want of labour, we tried the perchloride of mercury solution as being simpler and easier of application. In the two areas I have quoted it seemed to have distinctly good effects.

19,951. I believe you did something more than mere disinfection?—Yes, that was later. One particular quarter of the town was evacuated.

19,952. What measure do you regard as successful in dealing with an infected area?—I think evacuation and disinfection.

19,953. Have you had any experience of evacuation without disinfection by chemical disinfectants?—Without any disinfection at all? In some of the villages there was very little done more than opening up the houses, removing the tiles, and letting a free percolation of air through them.

19,954. And after evacuation?—I do not know any instance in which the people were allowed to enter their houses again within a month, very often two or three months, and after the plague had ceased among them out in their sheds.

19,955. What followed from their return?—They had no more plague.

19,956. That is to say without chemical disinfection, and simply by opening up the houses you found those houses did not again infect people when they returned?—That is so, after a lengthened stay away from the houses.

19,957. Have you any experience of disinfection after very brief evacuation—say a week or a few days?—In Bulsar, in two of the quarters there, I allowed the people to re-occupy their houses within a fortnight, I think.

19,958. No briefer period?—No.

19,959. That was in the case of houses which had been disinfected by chemical agency, I suppose?—Yes.

19,960. What was the result?—They had no more plague after the fortnight.

19,961. What is your opinion as to the infectiveness of plague in its different forms?—The most common form—the bubonic form—does not seem to be very infectious. We had numerous instances of Hospital Assistants, and particularly children having to be taken in with their sick mothers, and they never were affected by plague afterwards.

19,962. What is your experience with regard to corpse bearers?—From some statistics I collected in Surat

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there does not seem to be any special danger attached to corpse bearing.

19,963. How many people were you dealing with?—I was dealing with nearly 400. In only two or three instances was there any suspicion that the plague might have been contracted in that way.

9,964. You think that the bubonic form is not very infectious?—Yes.

19,965. How do you account for the occurrence of a considerable number of cases of bubonic plague in one house?—I should say they contract the infection from the original source. The house is infected and the germs enter through the abrasions of the skin.

19,966. What is your experience with regard to the infectiveness of pneumonic plague?—I have had no experience at all of the pneumonic form.

19,967. You saw no cases?—I could not say whether the cases I have seen were primary pneumonia or secondary pneumonia following on plague.

19,968. You have no clear cases?—I have no clear evidence at all.

19,969. Have you any experience of curative sera?—None whatever.

19,970. Have you any experience of Haffkine's prophylactic fluid?—Yes, I had some experience, but it was not entirely my own. All the figures I have obtained were got from the Assistant-Surgeon in Bulsar.

19,971. They are not your own?—No, they are obtained from him.

19,972. Can you give us those figures?—Yes. In an isolated corner of the town there were 1,018 people inoculated, and I have the figures of a portion of those people, some Muhammadans who had plague very badly. There were 539 of these Muhammadan weavers, of whom 490 were inoculated, and of the remaining 49, 20 were not inoculated because they had had plague in the previous year, three were not inoculated because they were sick with plague at the time, and 17 were not inoculated because they were children under two years of age; nine persons escaped inoculation of whom we have no record. After the inoculation of these 490 persons 64 cases of plague occurred with 23 deaths.

19,973. Do you know the intervals which elapsed between inoculation and the occurrence of plague?—I can only give the weeks and the number of cases.

19,974. Do you know how many deaths occurred among them?—No, I do not.

During	1st	week	after	inoculation	there were 12 cases.
,,	2nd	,,	,,	,,	12 ,,
,,	3rd	,,	,,	,,	15 ,,
,,	4th	,,	,,	,,	11 ,,
,,	5th	,,	,,	,,	8 ,,
,,	6th	,,	,,	,,	3 ,,
,,	7th	,,	,,	,,	3 ,,
					64

19,975. Were these inoculated persons left in the village or town?—They were left in their houses with their sick.

19,976. Previously to inoculation, had many cases of plague occurred there?—In an adjoining quarter there were some fishermen living, and there were about 20 or 30 cases among them.

19,977. Not in this actual quarter?—Not in this actual quarter.

19,978. Was any measure taken in the adjoining quarter?—The whole of the fisher people were inoculated as well as these Muhammadans, and some Muhammadans in the adjoining quarter, but I only have reliable figures about these particular Muhammadans which I have mentioned. Among the Muhammadans inoculated in the adjoining quarter who had not plague at the time no epidemic ever broke out.

19,979. (*Dr. Ruffer.*) How many times did you inoculate the Muhammadans?—Only once.

19,980. Did they all re-act?—I do not think they did. I did not do it, and I did not actually see it done.

19,981. Do you know the actual number of plague cases which occurred among those who had had plague before?—I know of one instance. A boy who had had plague the previous year got plague again the second year.

19,982. Then you stated you had 17 children under two years of age; do you know whether any of them got plague?—I am afraid I cannot say among whom the cases in the people left out occurred, whether they occurred among the people who had had plague the year before or among the children or those who escaped inoculation.

19,983. But you know of one case of a boy getting plague twice?—Yes.

19,984. (*Prof. Wright.*) Did you see any of these cases which occurred among the inoculated?—Yes.

19,985. You thought they were much milder than the cases among the others, did you not?—The mortality was considerably different. Some of the cases were very severe, but I think, on the whole, the epidemic was milder; the mortality was only half what it had been the previous year.

19,986. You state, in your précis, that other people refused to be inoculated?—In the rest of the town.

19,987. Because there was still plague?—Yes, among those who had been inoculated.

19,988. Were the symptoms in the inoculated persons so severe as to frighten the people?—No; I think the simple reason was that the inoculated people still continued to have plague among them, although they had been inoculated, and the other people did not see at the time there was any benefit to be derived from inoculation.

19,989. Do you think the inoculated were the same class of people as in the other quarters of the town?—There is another quarter containing exactly the same class of people, and they had plague afterwards. Their mortality was very much the same as in the previous year, over 70 per cent. They were exactly the same class, Muhammadan weavers, only they lived in a different part of the town.

19,990. 70 per cent. was the percentage of mortality among those attacked?—Yes.

19,991. Do you know what the percentage of attacks was among them?—Their numbers were altogether 492, and they had 65 cases with 47 deaths.

19,992. (*Dr. Ruffer.*) Are the two quarters about the same?—Very much the same. In one quarter there were 151 houses, and in the other 141 houses.

19,993. (*The President.*) Were they similar houses?—Yes, exactly similar, and a similar class of people. The population would be almost exactly the same.

19,994. (*Prof. Wright.*) It works out that there is about the same percentage of attacks among the uninoculated persons, but a greater mortality than among the inoculated?—Yes; the number of attacks among the uninoculated was about the same, but the mortality was greater.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

FIFTY-SECOND DAY.

Tuesday, 21st February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

MR. J. P. HEWETT.
PROF. A. E. WRIGHT, M.D.
MR. A. CUMINE.
DR. M. A. RUFFER.

MR. C. J. HALLIFAX (*Secretary*).

Major M. A. T. COLLIE, I.M.S., called and examined.

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19,995. (*The President.*) You are in the Indian Medical Service?—Yes.

19,996. And Superintendent of Matheran?—Yes. I have control of the station there, and complete control of plague matters.

19,997. (*Dr Ruffer.*) Will you tell us what has been your experience of plague?—My first experience in the first epidemic was chiefly administrative, for the Ratnagiri Collectorate. We simply tried to protect the district as far as possible from the introduction of plague by having passengers examined at the chief ports of call.

19,998. Where is that district?—It extends along the coast from Bankote Creek down to Vingorla.

19,999. How large is the district?—I forget how many miles it is.

20,000. Is that all the experience you have had?—No, after that I came up from Bombay, and I was placed in charge of the D. and E. wards in Byculla, in addition to my other work; and during that time I was Medical Officer of the Umarkhadi Jail.

20,001. I believe you say that there is difficulty in diagnosing certain cases of plague. Could you tell us what is the difficulty in diagnosis?—At first we were led to believe that the most stereotyped thing was simply an enlarged gland, and from that that there was no difficulty in diagnosing any case of plague. At first, however, I found extreme difficulty in diagnosing any case of plague at all. Even where we made *post mortem* examination of cases of enlarged gland, we could find none of the local signs of plague, even microscopically. If a case of sudden death was reported, or even if we saw people 48 hours before death, there was great difficulty in the diagnosis.

20,002. What was the chief difficulty in the diagnosis?—They appeared to be only suffering with fever.

20,003. Had the majority of cases an enlarged gland?—Not unless I saw them during life.

20,004. You saw a certain number of cases of fever without enlarged glands, which you diagnosed as plague?—Yes, after death.

20,005. Why did you diagnose them as plague?—Simply from the microscopical appearance.

20,006. Did you make a bacteriological examination?—I could not carry out the bacteriological examination, but I made a microscopical examination of every case I could.

20,007. In how many of the cases in your district did you diagnose the case after death?—In Hubli every case was diagnosed after death. I did not see more than three or four cases before death.

20,008. Were you in active service there, looking for plague cases?—Yes.

20,009. You think at the beginning most of the cases in Hubli were non-bubonic cases?—I cannot say that, for I did not see them till after death, except in about four cases.

20,010. Were most of the cases which you saw after death non-bubonic cases?—I could not find any bubo. When we came to look for the swollen glands that I saw during life, at the *post mortem* examination, I could not find them.

20,011. They had disappeared?—Yes.

20,012. Is that frequently the case?—I have not had sufficiently large experience to say.

20,013. How many *post mortems* did you make altogether?—During the time I was at Hubli I had 14 deaths, and I *post mortemed* every one.

20,014. How many had buboes?—I cannot give you that information. There was one case, for example, of a child who had several enlarged glands over the body, and I only found the ordinary *post mortem* plague appearances in one small gland of the neck, although the child had enlarged glands in the groin and the axilla, and there was none of that effusion of blood round the glands as we usually find, except in the cervical gland.

20,015. Was that a rapid case?—Yes, as far as we could gather.

20,016. Did you see any other cases like that?—I saw one woman which I had diagnosed as plague beforehand. She had an enlarged gland round the angle of the jaw, and she died within a few hours, but I could not find the glands after death.

20,017. It is your opinion that if you find a dead body in the street, unless you make a microscopical or a bacteriological examination, you cannot diagnose plague with certainty?—Certainly not.

20,018. In cases of plague pneumonia, did you find anything special after death?—No.

20,019. Did you see any cases of plague pneumonia at Hubli?—I got three cases there which showed *post mortem* signs, with ordinary complications.

20,020. Primary plague pneumonia?—I did not see them in life. In the obstetric hospital where I have been in charge for several months, I have seen cases come in there just moribund. They were brought in in a moribund condition, and as far as I could gather they had symptoms of plague.

20,021. Did you ever notice œdema of the front wall of the chest in cases of plague pneumonia?—No.

20,022. In the cases of plague without buboes, did you examine the other organs of the body for plague bacilli?—Always in the spleen or liver.

20,023. Did you find them?—If I did not find the glands, I found them in the spleen or liver before I gave my diagnosis.

20,024. Do you think there is much difficulty in diagnosing plague during life?—I think so.

20,025. Why?—It is very difficult to diagnose in many cases.

20,026. Why do you say in many cases?—I would not be prepared to swear to any case that I saw.

20,027. Unless you saw enlarged glands?—Or even then.

20,028. Why not?—Take the case which came up to Matheran, which is a small hill station four hours

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from Bombay. He is the son of a Parsee gentleman. He travels first class. He was seized with rigors, and his temperature rose to 105. He gives me a history of chronic eczema of six years' standing. He had an enlargement of the femoral and inguinal glands in both groins, one was especially large, but he is convalescent now.

20,029. Is that a case of plague?—I cannot say, but I believe it to be, because he came from a house where dead rats were found and because another person was taken from that house to the Parsee Plague Hospital and died. I telegraphed down, as soon as the case came in, for pipettes and culture tubes, &c., but before they arrived he was convalescent, and Dr. Galeotti had injected 15 c.c. of Lustig's serum.

20,030. I suppose the diagnosis is difficult also in septicæmic cases?—Yes.

20,031. Do you think it is possible to diagnose a septicæmic case of plague in many cases, unless a bacteriological or a microscopical examination is made?—I think not.

20,032. Do you think the ordinary person who is in charge of a plague ward, who is not a medical man, would be able to diagnose a case of septicæmic or pnuemonic plague either during life or after death?—The first few cases I sent down from the Umarkhadi prison, I was very doubtful about. They were the first cases that occurred, and I think the first man had been 56 days in prison. I got Dr. Leon, who was working in my district, to come and take a little serum from the gland, and we sent the case down as one of plague. I sent the man to the Plague Hospital, and went round the next morning, and was told that he had had the glands for several years, and that it was not a case of plague at all, and I assumed that the patient was better. I asked how he was, but he was dead. This was the Arthur Road Hospital. We got our culture tubes there, we got characteristic cultures, and had microscopical examination in life, and yet it was pronounced by one of the staff of the Plague Hospital not to be plague.

20,033. Have you had recently any hospital experience of plague?—Not recently.

20,034. You have been to Plague Hospitals?—Yes.

20,035. Have you got any data to show that other patients besides plague are admitted in Plague Hospitals?—Certainly.

20,036. Could you give us examples?—When I had charged of the Narelwadi segration camp, people came down from Cutch. It was in October or November. One man had an enlarged gland which, on careful enquiry, I found had existed probably since childhood. After satisfying myself that it was not plague, but simply intermittent fever he was suffering from, I discharged him from the segregation camp after keeping him five days under observation. Within three hours one of the spies, or whatever they were, who were employed by the Plague Commission, seized this man while he was eating his food, and sent him to the Plague Hospital.

20,037. Had he fever at the time?—No.

20,038. The diagnosis was based simply on the enlarged gland?—Yes. I traced him to the Plague Hospital and turned up the case. He was treated entirely as a case of *pestis ambulans*. The man went to work within a day or so after his discharge from the hospital, after being there for only four days. He had no plague.

20,039. Have you seen cases of relapsing fever in Plague Hospitals?—I have seen cases of relapsing fever, but not in hospitals.

20,040. Have you seen any cases of malarious enlargements of glands admitted as plague patients?—Only that one that I mentioned just now, but not any others to my knowledge.

20,041. Have you ever seen cases of syphilitic glands or gonorrheal glands admitted as plague?—I have not seen them; I have heard of them. I have no personal experience.

20,042. I believe you are a strong advocate of "the "importance of quarantine versus surveillance and "inspection as examplified in the occurrence of plague "throughout the Ratnagiri Collectorate in the first "year's epidemic." Can you give us any evidence as to why you prefer quarantine to surveillance and inspection?—It is based entirely on the fact that unless you can observe a person for 10 or 12 days you do not know whether he is in the incubation stage or not. He passes up-country, and in the Ratnagiri Collectorate there were 300 odd cases of plague and nearly half of them were indigenous.

20,043. How could you establish a perfect system of quarantine in the Ratnagiri Collectorate, for instance?—Only by allowing the people to land at certain ports.

20,044. Could you prevent them landing in other places?—If the authorities in Bombay Harbour only give clearances to specified ports. I think it is one of the districts that could be most easily managed. It is entirely a coastal service, and people get down by steamer or by native craft, and there are very few roads from the other side of the Ghats.

20,045. Cannot they go down by land?—It is very inaccessible; all travel by sea.

20,046. Supposing they knew that the sea route was closed, would not they come by land?—The journey is so long that they would not do it. It practically embraces quarantine. The nearest station by land is Kolhapur, which is 40 miles from Ratnagiri frontier.

20,047. That is a day's journey?—You will not do it in a day.

20,048. Say two days?—They have to go up and down the Ghats.

20,049. I want to know how you can protect a large tract of country like a Collectorate. How many men would you want to protect a Collectorate by quarantine?—The proposal was that native craft should only get clearing papers for certain ports.

20,050. What prevents them from going into other ports?—The Customs authorities along the coast.

20,051. I suppose there is a certain amount of smuggling there like everything else. Why could they not smuggle plague cases?—They might do it. They might land them on the shore.

20,052. Supposing you had quarantine, do you think the people would try to avoid the quarantine measures?—I think they probably would.

20,053. You say you have seen "the occurrence of cases in quarantine camps up to eight days, and in one case 12 days"?—Yes.

20,054. Were the people disinfected before they entered quarantine camp?—Yes.

20,055. Were there any other cases of plague in the quarantine camp at the time?—One was in what you might call an "observation camp" where the people had been taken from an infected area. The other case of 12 days was a case that came up from Goa and was put into a quarantine camp because we did not know the condition of Goa at the time.

20,056. Did you disinfect the clothing?—Yes.

20,057. Did you disinfect every person's clothing?—Every person's clothing was disinfected by the steam steriliser.

20,058. There have been no cases of plague in the camp?—No.

20,059. You advocate "early removal of people from "infected areas with liberty to carry on their daily "avocations out of the health camps"?—Yes.

20,060. You also say there are "difficulties in pronouncing when an area or town may be declared free, as exemplified in the case of Hubli"?—Yes. There was a very careful census taken there, and a very careful system of inspection of houses &c., and as far as we could find out no cases occurred except at intervals. First there was the 9th and 10th of January, then you pass on to the 18th, which is a doubtful case. It is put in as a case, but it was not recognised as occurring until the 30th, that is 20 days.

20,061. May not that case have got plague somewhere else and not in Hubli?—No, we are certain about that.

20,062. Why?—Because he was not out of Hubli.

20,063. Supposing a case of plague had come to Hubli and died, could you exclude any possibility of Hubli being infected?—He was known by the census; he was in the roll-call every morning.

20,064. But supposing a man had come from outside to Hubli, and died from septicæmic plague, which is difficult to recognise, could you exclude that possibility?—Except that all the roads were controlled. Of course, it is impossible to say that they did not get there; you cannot exclude it.

20,065. Can you give us any examples of plague being introduced into a community by means of clothing?—Yes.

20,066. Would you give us the details?—The first case that came to my notice was at a village of Ladghar, which is about eight miles from Hurnai in the Ratnagiri collectorate. A Bhandari, one of the fisher class, had lost his wife, and he came to Bombay and took down her jewels and her clothing. Within a few days after his arrival in the village dead rats were first observed, and then the first person to suffer was an aunt who lived in the same house, and then a nephew, and then the son, and finally the Bhandari himself who had brought the infected clothing. He died, and altogether in that village we had 47 attacks and 39 deaths.

20,067. How long after the clothing was brought down was this first attack?—I had to inquire from a Hospital Assistant, who was on duty there, and he says in an indefinite way that dead rats were first observed two or three days after the man came down from Bombay.

20,068. Is there no possibility of plague having been introduced into that village in some other way?—They are all people who live by fishing and toddy drawing and no one had left the place except this man.

20,069. Can you tell me what the total mortality of that village had been in the preceding weeks?—I cannot.

20,070. Was the total mortality of the village raised?—There was no report of it. Inquiries were made in all these cases, and there was no unusual mortality.

20,071. Rats were found two or three days afterwards?—Yes.

20,072. The clothing must have infected an enormous number of rats very quickly?—I cannot tell you that.

20,073. I can understand a great many rats being found dead a week afterwards, but it is difficult to believe it was found within three days?—You know what a native's statement is; it is possible that plague had existed for some time before we had intimation of it. A native is always very indefinite with regard to his time statements.

20,074. Have you any other evidence of plague being carried by clothing?—At a village called Guhagar, down the coast, a boy who had recovered from plague was brought down by his friends, and stayed at an aunt's house. They had a feast of some kind there, and it was said that he brought down the clothing with which he was discharged from the hospital. Ten days afterwards his aunt sickened with plague and died and then one of her children.

20,075. There was no plague in that village?—No.

20,076. Did not any rats die?—No. There was another case at Hubli. The whole of the infected area had been cleared out, and this man had been 20 days up in the health camp. The whole of this area was under the charge of the police. He had heard that I wanted to destroy his house, which was next to the first infected house in that area, and he went back to his hut to remove some clothing from there, and within 11 days from that occurrence he sickened from plague in the health camp and died. He had been 20 days altogether (supposed to be) in the health camp.

20,077. There was no other case of plague in that health camp?—No, the whole of that had been cleared out.

20,078. Were the health camps under the observation of medical men?—Yes.

20,079. Every day?—I went up every day; there was a roll-call every evening and morning.

20,080. Had the clothing of the people going into that health camp been disinfected?—Yes, all through the steam steriliser, as far as I could say.

20,081. Are you certain of that?—Officers were appointed to see that it was done.

20,082. Who are the officers?—Lieutenant Keelan had charge of the disinfection, and there was a Hospital Assistant who would not allow things into the camp unless a chit was given stating that the things were disinfected.

20,083. Have you any other examples of plague being communicated by clothing?—No.

20,084. You say you have "examples of plague being "introduced into a community by means of clothing, "and of a man contracting plague by surreptitiously "revisiting a cleared area"?—Yes. This man, as far as I could gather from his wife, had removed a pagri from that place, and whether it was from the pagri or not I cannot say.

20,085. You think it is important that railway authorities should look after their own employés?—Certainly.

20,086. So as to prevent the spread of plague from one district to another, because they travel through large tracts of country?—Yes. As an example, I may say that a railway guard was found at Hubli station travelling from Belgaum to Bezwada. His father and his brother and his sister-in-law had all died of plague, which was not diagnosed as plague, at Belgaum. At the railway station at Hubli he removed his wife and his mother and they died of plague in a few hours. This man travelled down from Belgaum with a pass to Bezwada.

20,087. Did he himself suffer from plague?—No, and the children did not suffer.

20,088. How did the disease reach his mother and wife?—His mother and wife died in the railway quarters.

20,089. You believe in "the importance and necessity "for the medical officer being alone the organiser and "director of all plague measures." Can you tell us what you base that on?—The whole training of the medical officer is to deal with disease. He knows the disease and he knows how best to deal with it, and he knows the people. At the time I was working here in Bombay I was constantly interfered with; for example, I got a hard and fast rule laid down to me that if persons had a temperature of 102 degrees in the segregation camp, I was to send them to the Plague Hospital, whether I thought they had plague or not. I do not think that is an order that should be issued to a qualified person.

20,090. You think that was a mischievous rule?—Most certainly. In many cases, if I had acted upon it, I should have sent malarial fever there; but I never did act upon it.

20,091. Can you tell us any other rules that you consider unnecessary?—When they first introduced the order as to clearing out persons from areas in which dead rats were found, I regarded it as a most rational thing to clear the whole of that area out. I cleared out from one chawl near Bombay about 80 people, and I got an order the next morning that I was not to do these things in such a wholesale manner; that I should simply take the room in which the dead rats were found, and the two neighbouring rooms.

20,092. Where were the two neighbouring rooms?—One on each side of the room on which the dead rats were found.

20,093. Do you know the reasons why they said the two neighbouring rooms?—I cannot give you the reason.

20,094. Can you give us any other instances?—I think the medical officer should be allowed to control all these things himself.

20,095. And you think, probably, that the difficulty of diagnosing cases of plague is also in favour of your contention that the medical officer should be in charge?—Certainly.

20,096. (*Mr. Hewett.*) Were you at Hubli when the census was taken there?—No.

20,097. Who took it?—Dr. Meyer.

20,098. You refer to a case in January 1898, which took place 23 days after the one immediately before it. Do you attribute the infection in this instance to the man having got infected in a house which contained the poison?—After careful inquiry, I found that he went back there with his wife.

20,099. Is not that the man that went back from the segregation camp?—Yes, the same man.

20,100. Is that how you think he got infected?—I believe he stayed there all that night. The evidence is that he was drunk that night, and he must have slept there.

20,101. Raga Appaji is the man?—Yes.

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20,102. (*Mr. Cumine.*) You spoke of a Bhandari boy. Are they fisher people, or toddy tappers?—I think they do both.

20,103. What was the interval that elapsed between the arrival of the boy and your hearing of the death of the woman?—We heard of the death of the woman about a week after her death. We had a system of weekly reports.

20,104. Who brought the boy down from Bombay? Did some friends come with him, and deposit him and go away again?—Some Bhandaris came with him, and they went up the coast, and came back again. They were owners of a native craft, and they brought him down from Bombay and deposited him at his aunt's house, and went away.

20,105. Can you exclude the possibility of their having plague in their bodies when they deposited him and went away?—No, I cannot exclude that.

20,106. Is not there an observation ward for doubtful cases attached to each of the public hospitals in Bombay?—I cannot say.

20,107. As regards the man whom you released from the Narelwadi camp, and who was sent to the hospital, can you say for certain whether he was put into the plague ward, or into the observation ward?—I was told that he was put into the plague ward, and that he was treated as a case of *pestis ambulans*. I went to the hospital and saw the charts and notes of how he was treated.

20,108. What did you think it was at first?—I had no doubt about it being malaria, and I kept him in the Narelwadi observation camp. He had fever one day, and then an intermission, and then he had another attack of fever. I discharged him as soon as I was satisfied that it was malaria.

20,109. When a district is very heavily infected like Satara, with many infected villages, how could a medical officer manage everything there himself?—He must be the organiser; he cannot be everywhere himself. He must be the administrator in all these things, and, as far as possible, he should have skilled Hospital Assistants—the same as in cholera; you cannot be in every village when cholera breaks out.

20,110. I think you said that medical men are not invariably able to diagnose a case as to whether it is plague or not?—I think it is very difficult.

20,111. What are the other respects in which you think they are superior to, say the Revenue Officers or the Police Superintendents?—Their whole medical training is to deal with disease; they are not likely to act rashly, like a person belonging to the laity, who is not accustomed to deal with it.

20,112. I think you said there was a man from Goa who developed plague in the quarantine camp after 12 days?—Yes.

20,113. Were there any plague cases then in Goa?—We could not find out. I do not know whether anybody knows yet.

20,114. Has plague ever been officially declared in Goa?—No. I heard there was a great deal of sickness and large mortality. The Goanese told me that themselves.

20,115. (*Prof. Wright.*) Were you in charge of the Umarkhadi Jail when the inoculations were done in January last year?—Yes.

20,116. How long did you continue in charge of the jail?—I gave up the appointment on the 4th January, but I had been in charge of it for three months.

20,117. The inoculations were done about the 1st?—Yes.

20,118. You have no personal knowledge of what happened afterwards?—No.

20,119. Did you supervise the selection of the candidates for inoculation?—I was present there. A bell was rung, and the prisoners marched in. They were mustered in a row, and there was no selection made.

20,120. Were all the prisoners allowed to be inoculated if they so desired?—They were told they were going to be inoculated, and that if any prisoner objected very strongly he would not be inoculated.

20,121. Was every second man inoculated?—Every second man, unless they had fever, or were very old and debilitated, or objected. I think there were not two objectors in the whole lot.

20,122. I understand that some of the prisoners worked at outdoor, and some at indoor occupations?—No, not in Umarkhadi.

20,123. Were they all engaged on indoor occupations?—All indoor.

20,124. Were they all employed in the same occupations?—Not all the same. I had not charge of the employment of prisoners, but I know that some do grinding, some do the teasing of oakum, some treadmill, and some the making of mats, and such like.

20,125. Were the occupations of the inoculated different to the occupations of the uninoculated?—No. There was no distinction; the occupations are changed very frequently, so as not to allow them to mingle too much together.

20,126. Did you see the febrile reactions that followed upon the inoculation?—I took the temperature in every case.

20,127. Did you find any very high temperatures after inoculation?—I think the average temperature was 101 and 102; some went up to 104.

20,128. Are there any records of these temperatures?—Yes, there must be on the files in the hospital.

20,129. Did you take the temperature of every person inoculated?—Every temperature.

20,130. Did you find much difference in the reactions?—Yes, some had very little reaction, and some very strong reaction.

20,131. Where are these records to be got?—They should be on the files of the hospital. I told the Hospital Assistant to keep them, but he is changed now, and I do not know whether they would be accessible now.

20,132. (*Dr. Ruffer.*) Do you think plague is a more easily diagnosed disease than any other acute infectious disease?—Do you mean small-pox or measles?

20,133. Yes, or any other?—I consider it is far more difficult to diagnose plague.

20,134. (*The President.*) If it be more difficult to diagnose, is it not your opinion that the work of diagnosing should be done by trained diagnosers, such as medical men?—Yes.

20,135. (*Dr. Ruffer.*) You think most men now negaged in plague work are absolutely incapable of diagnosing a case of septicæmic plague?—I think so.

(Witness withdrew.)

Capt. C. H. L. Meyer, I.M.S.

Captain C. H. L. MEYER, I.M.S., called and examined.

20,136. (*The President.*) You are a Doctor of Medicine, I believe?—Yes.

20,137. I think you can give us some information with regard to the first outbreak of plague at Hubli?—Yes.

20,138. (*Mr. Hewett.*) I believe you were only employed during the first epidemic at Hubli?—Yes.

20,139. That was a very small one?—Yes.

20,140. Was the first case in a railway chawl?—Yes.

20,141. Did you trace how the infection came there? As far as we could trace it, it seems to have been brought from Poona by railway employés. Some railway employés had gone on leave to Poona, and they brought the infection with them on their return.

20,142. When we were there a short time ago it seemed to be possible that the first infection was due to the arrival of a family from Sholapur: do you think that that is likely?—I investigated that. I did not put any reliance upon it.

20,143. You think, then, that railway employés brought it from Poona?—Yes.

20,144. Was the railway chawl at that time in an insanitary condition?—Only, or chiefly, as regards ventilation. The ventilation was extremely bad. The chawls were placed together, and the windows were small. The weather was cold, and the houses were

shut in by verandahs. The ventilation, both external and internal, was very bad; it was very deficient indeed. The other sanitary conditions were fairly good.

20,145. How many cases occurred in the railway chawls?—35 altogether.

20,146. How long after the detection of the first case did you evacuate the chawl?—The first case occurred about October the 10th; I did not arrive there until the 27th, and we commenced to evacuate about October three or four days later.

20,147. How long did it take to complete the evacuation?—Four or five days.

20,148. At what time was the cordon placed around the railway chawl?—On the 23rd of October.

20,149. Did you find the cordon efficient?—We had a large force of police. They were native police, however, and we could not thoroughly trust them.

20,150. Do you remember how many police you had?—I think we had about 60 on duty constantly.

20,151. Notwithstanding that, people came into the chawls and got out of the chawls, did they not?—The way plague was once carried into Hubli, was this. A friend of a policeman came to see him. This policeman was on the cordon, and his visitor slept a night in the cordon—I really believe in one of the empty chawls. The police were in the habit of going into these empty buildings and sleeping in the verandahs of the chawls: it was very cold. This visitor got infection there, and carried it into the town.

20,152. Did any people escape from the chawls to the town and get infection?—No.

20,153. Did not a Goanese do so?—No; the only case we could trace was the one I have mentioned.

20,154. Did you find that the moving of the inhabitants outside their houses had the effect of stopping the epidemic in the chawls?—Yes.

20,155. How long did it take to do that?—The epidemic in the chawls was practically over by December the 13th.

20,156. That was six weeks after you had taken the people out?—About a month or five weeks after they had all been taken out.

20,157. What was the number you had taken out of the chawls?—About 1,200 people.

20,158. You think it is very important to prevent people from returning to infected houses after evacuation?—Yes; I was on plague duty for a short time at Lanauli, and then also at Hubli, and I found that if you disinfect houses ever so thoroughly, and let people go back again into the houses after a week or a fortnight, they frequently got plague again, as the houses are still dangerous.

20,159. Could you exclude all possibility of infection from outside in this case?—I could not, certainly.

20,160. How long would you keep the people out of their houses?—Until the epidemic was over.

20,161. Have you anything to say as to the various methods of disinfection?—I do not believe very much in the disinfection by solutions; I think it is quite impossible to reach every crevice in a house and thoroughly disinfect it in that way; I would rather trust to taking off the roofs of the houses and letting in the sun and the air. The burning out of the houses is better still.

20,162. What do you mean by burning out the houses?—In the railway chawls at Hubli, I unroofed the houses, and put into each separate chawl a quantity of combustible bamboo material and grass and set that alight. The interior of the chawls was so hot after this treatment that you could not go into them for two or three hours after the fire had burnt out. That method, I think, must be efficient.

20,163. When a disinfecting solution is used, do you think it is necessary that the whole of the roof should be disinfected?—I always thought so.

20,164. You think there is a possibility of infection from the roof?—Yes, rats run about in the roofs.

20,165. There was a scheme started in Hubli, I believe, for detecting plague cases?—Yes. The town was divided up into a number of wards. There were about 12,000 houses in Hubli and we divided the town into 120 parts. And over each lot of 100 houses we put a Supervisor. This man took the census of the houses and he visited them every day. He made reports of any new arrivals at these houses, and also in cases of death and of sickness.

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20,166. During your time were many cases of sickness reported by the Supervisor?—Yes.

20,167. Lieut. Keelan who followed you, told us yesterday that the majority of cases in Hubli were reported after death; that would rather show that this system of supervision is not very effective?—It was effective in discovering the plague cases after death, not very effective in discovering them before death.

20,168. Do you know how the town of Hubli became infected in the second epidemic?—No; I could not tell you. I only know after I gave up charge at Hubli on January 9th, there were no further cases of plague until January the 30th. After that there were dropping cases all through February, March, and April, and then the cases gradually increased and the second epidemic was at its height in July.

20,169. Were you in Hubli at the time the Mahratta Gali was burnt?—No; before I left we evacuated the Mahratta Gali, and the houses all around the quarter which we supposed might be infected.

20,170. So far as we could ascertain when we were at Hubli the outbreak seemed to have stopped with the Mahratta Gali, and the second outbreak seemed to have been due to fresh infection; do you think it is likely to be possible?—Yes; fresh infection would be very probable, because infected Belgaum was not very far away, and there were other places not very far away where there was plague. The people were travelling about a great deal, and there was constant danger of infection being imported from these places, especially from the Belgaum district.

20,171. You know nothing about inoculation at Hubli?—No, it was after my time.

20,172. While you were there was the census of the inhabitants taken?—Yes.

20,173. In what month?—In December.

20,174. Was Capt. Leumann there at the time?—No.

20,175. Under whose direction was it taken?—Under the directions of the Collector.

20,176. Was any European employed in connection with the taking of it?—No, I do not think so.

20,177. During your time there, did anything come to your knowledge to make it appear that people had left the town?—No; they did not leave the town much in my time; there was no scare then.

20,178. Were people coming into the town from outside?—They were leaving the town and coming into the town in the usual way. There was no scare or panic—nothing to frighten them.

20,179. Do you think that at the time the census was taken the population would be normal?—Yes, I think it was found to be so by the figures. The normal population would be something like 48,000 or 52,000, I cannot remember which.

20,180. You had nothing to do with taking the census?—No.

20,181. The Supervisors took it themselves?—Yes.

20,182. How many houses was each Supervisor responsible for?—One hundred.

20,183. Do you know whether for the purpose of tabulating the census returns, the Supervisor visited each of these 100 houses on one particular day?—I cannot say that he took his census on one day; it was probably done within a week.

20,184. (*Dr. Ruffer.*) When you speak of efficient disinfection not being sufficient to stop plague in a house, you mean disinfection by heat?—I mean particularly disinfection by solutions. I had an experience of that at Lanauli; I carried it out under my own supervision very thoroughly; in fact, I worked the pumps myself. I found that when I let the people into the houses they got plague.

20,185. What solution did you use?—Perchloride of mercury.

20,186. Acid?—No; I dissolved it with sodium chloride; I used a strength of about 1 in 800.

20,187. Did you use it in pumps?—Yes.

20,188. Did you make the solution yourself?—Yes, so as to make sure it was correct.

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20,189. Did you find that the sublimate dissolved easily?—I made it over night, and left it to stand about 24 hours.

20,190. Did you find that it had dissolved by the next morning?—Yes.

20,191. What temperature did you get in the chawls by lighting the fire and burning the bamboo material?—It was a very high temperature. It was so high that you could not possibly go into the interior of the chawls

20,192. I want to know what you mean by a very high temperature. If the temperature was up to 60 or 70 you could not go into the room?—You could not face the heat. If you went to the door while the fire was still glowing, or even an hour after it had gone out, you could not enter the room.

20,193. Have you any idea what the temperature actually was?—No.

20,194. Do you know what degree of dry heat is necessary to kill the plague bacillus?—I do not know.

20,195. (*Prof. Wright.*) Was perchloride of mercury the only antiseptic you used?—Yes.

20,196. You did not try carbolic acid?—No.

20,197. Can you instance any particular cases which led you to doubt the efficacy of the disinfection?—I could not specify particular cases, but I know from my experience at Lanauli, as I told you just now, that when I had thoroughly disinfected houses there, and let the people return to those houses, after a week, they got plague in those disinfected houses.

20,198. Were all things turned out of the houses when they were disinfected?—Yes.

20,199. Were clothes disinfected?—Yes, everything.

20,200. Did you put the clothes in the solution of perchloride of mercury too?—Yes, and the furniture was all disinfected. Others have had similar experience in Bombay, and it was found that disinfection in that way was not efficient.

20,201. You took every precaution you could think of and disinfected clothes, floors, and roofs?—Yes, the the disinfection was very thorough; we tried to cover every spot. I attended to the disinfection of the houses and the clothing myself.

20,202. Have you any theory by which you can account for the want of success which attended your disinfecting operations?—Except that I think it is impossible when disinfecting the houses, to reach every crevice and corner in the woodwork and the stone work in the houses with disinfectants like that.

20,203. (*The President.*) When you disinfected by sunlight and fresh air and then allowed the people to re-enter, did you have any cases of plague in houses so disinfected?—The people never re-entered; the roofs were taken off and the houses made uninhabitable.

20,204. For what period of time?—In the case of chawls at Hubli they remained so until I left; I do not know whether those chawls have been re-entered or not.

20,205. You have no instances in which, after this method of disinfection, the houses were re-occupied? I do not know any instance.

20,206. You can hardly say whether it is efficacious; you cannot compare it with chemical disinfection?—I think it very important to keep the people out of the houses. After we had disinfected in that way, the doors were screwed up, so that the inhabitants could not possibly enter.

20,207. You have expressed an opinion that certain insanitary conditions were very favourable to the development and spread of plague?—What I meant was bad ventilation; especially want of sufficient air. The houses in Hubli and in the railway chawls were rather remarkable in that way. They were so very dark, even for an Indian city. The windows were very small and usually sealed up. There were a great many verandahs to the houses which prevented the circulation of air. The internal ventilation of the houses was extremely defective. In other respects the sanitary conditions of the houses in Hubli were excellent for an Indian city.

20,208. Were the dwelling-rooms clean?—Yes.

20,209. Was there any overcrowding?—Not greater than in other Indian cities; they are all overcrowded.

20,210. Overcrowding would tend to do what you say was so injurious—tend to vitiate the atmosphere, would it not?—Yes.

20,211. (*Prof. Wright.*) Did you lime-wash the houses after you disinfected them?—Yes, with solutions.

20,212. Do you not think that the application of lime is calculated to counteract the goods effects of the perchloride of mercury?—I did not think so at the time, but I do think so now.

20,213. Are the walls of the houses at Hubli made of mud, or of a mixture of mud and lime?—There is usually a mixture of lime in the walls, in these railway quarters, certainly.

20,214. Do you think that your ill-success in disinfecting might have been accounted for by that fact?—I had no bad success in disinfecting Hubli. At Lanauli I had to deal with mud walls. In Hubli itself, I carried out that disinfection, but I disinfected also by fire. In addition to that, I kept the people out of their houses.

20,215. Then it was your experience at Lanauli, which led you to doubt the efficacy of your disinfecting operations?—Yes.

20,216. What did your disinfecting operation consist of?—I used solution only, and did not disinfect by fire; I also limewashed the places, and I came to the conclusion from the experience I had of it in Bombay, that such a method was not reliable.

20,217. Do you think that the giving off of ammonia from cow-dung floors is a circumstance which might vitiate your disinfecting operations?—That would be an element.

20,218. Were any steps taken to neutralise the ammonia?—No.

20,219. (*The President.*) Were the floors cow-dung floors?—Yes, in almost all instances.

20,220. Supposing the materials of the floors consisted of a large quantity of albumenoid substances that would oppose the penetration, as it were, of the mercuric chloride, would it not?—Yes, it would.

20,221. (*Mr. Cumine.*) When you found that one application of perchloride of mercury did not appear to be sufficient to make the houses safe, did you try and repeat the application day after day?—No.

(Witness withdrew.)

Mr. W. T. Morison, I.C.S.

Mr. W. T. MORISON, I.C.S., called and examined.

20,222. (*The President.*) You are in the Indian Civil Service?—Yes.

20,223. What is your position?—Collector of Land Revenue, Customs, and Opium, Bombay.

20,224. (*Mr. Cumine.*) You were Collector of Sholapur in 1897?—Yes, till January 1898, from January 1897, one year.

20,225. You can tell us then about the severe visitation of plague which took place in Sholapur city. What month did it begin in?—It began outside the town in September, and it spread to the town itself in October.

20,226. How long did it last?—It was practically extinct from the town of Sholapur by the end of January 1898, but in the meantime it had spread outside. I am merely speaking of the town itself.

20,227. Is it known where the infection came from?—It is believed to have been brought from Poona.

20,228. By sick persons, or by clothing, or what?—As far as we could ascertain it was brought by a Goanese servant, who came to an officer's house in the cantonment. How it was brought by him we do not know, but his was actually the first case that occurred. He had been to Poona.

20,229. Please give us a short description of the epidemic in Sholapur?—Plague first broke out towards the end of September 1897 in the Sadr Bazar, an isolated, compact suburb about half a mile from the town proper, but within Municipal limits. The suburb could have been easily evacuated at once, as the inhabitants were most of them of the lower and poorer classes, and subsequent experience showed that this would have been far the wisest step to take at first. But we were new to plague operations, and thought that wholesale evacuation was too drastic a measure, besides being likely to spread the disease elsewhere. So we decided to try and confine the plague to the Sadr Bazar by drawing a cordon of police round it. The place was well suited for this, it was compact, with open ground on all but one side, and we had what seemed a sufficient number of police.

20,230. Was the attempt to keep the people in by a cordon of police successful?—It was a complete failure. The people began to melt away like mist, and we found that we were only guarding a gradually emptying suburb. In the first place, we had to let most of the healthy adults go every morning to their work. We issued daily passes to them, but refused to let their women folk and children go, hoping that this would bring the men back every evening. But the attraction was not strong enough, and most of the men remained away and were soon followed by their families, who arranged somehow or other to get through the cordon, by procuring passes under false excuses, evading the posts by night, or bribing the sepoys. Meanwhile the plague was raging among those that remained, and the absolute necessity for complete evacuation then became apparent. This was carried out about 15th November, the people being collected into a camp known as the Moti Bagh Camp, a mile off. As soon as we got the people into the camp there was a sudden and marked decrease in the number of cases among them, and in about a fortnight they were almost free of plague. Before this, however, the plague had spread to the city, and by the beginning of November a number of cases were occurring daily. Sholapur is a place of 62,000 inhabitants, and the total evacuation of it was a work of such magnitude that it hardly occurred to us at first. We began by evacuating the worst infected quarters, and from the weekly reports I find that by the 27th November four quarters containing 400 houses in all were evacuated.

20,231. Did you find that partial evacuation, evacuation of the infected quarters, was sufficient to prevent the spread of plague in the town?—So far as we found, it prevented it spreading quickly, but it had not the effect of absolutely stopping its spread. We found that it spread it spite of evacuation. It was impossible, however, in spite of every precaution, to prevent some of the inhabitants of these quarters taking refuge with friends in other parts of the town, and the plague continued to spread until every part of the town was infected. Evacuation was then carried on on a larger scale, and early in December we determined to evacuate the whole town, and an order was issued that by the 31st December the town was to be empty. At the same time a large camp was laid out in a convenient open site between the town and the railway station, and another to the east of the town. In these sites, streets of shelters made of gunny bags were erected at Government expense (each shelter costing Rs. 5, I think) for the poorer people, and sites were pointed out to the well-to-do, where they could put up their own huts. Large numbers, too, went and lived on the fields outside the town. When once the people saw that total evacuation was decided on, little pressure was wanted to make them leave the town. There was naturally a rush for the best places in the new camp. The town, too, with its many empty and silent streets, often tenanted only by an occasional corpse, had an uncomfortable and haunted feeling about it at night, which was increased by exaggerated rumours that gangs of dacoits from adjacent Hyderabad territory were about to descend on it.

20,232. Did the town ever become completely empty, and if so, on what date?—It became completely empty by the end of 1897.

20,233. Can you show us by figures what the effect of this total evacuation was?—The effect of this total evacuation can be best realised from the study of the weekly returns of plague cases. The following table shows these returns from the end of September to the end of March:—

TABLE showing the PROGRESS of PLAGUE, Week by Week, within MUNICIPAL LIMITS of SHOLAPUR CITY, including all SUBURBAN HEALTH CAMPS.

Week ending	Imported.		Indigenous.	
	Cases.	Deaths.	Cases.	Deaths.
1st October 1897	—	—	13	9
8th "	—	—	6	4
15th "	—	—	26	8
22nd "	—	—	50	45
29th "	—	—	116	90
5th November 1897	—	—	146	117
12th "	—	—	143	118
19th "	—	—	221	182
26th "	—	—	363	297
3rd December 1897	—	—	502	377
10th "	—	—	501	436
17th "	—	—	300	246
24th "	—	—	134	149
31st "	—	—	53	36
7th January 1898	—	—	26	27
14th "	—	—	9	9
21st "	—	—	7	11
28th "	—	—	5	8
4th February 1898	—	—	1	2
11th "	9	1	—	7
18th "	1	—	1	4
25th "	1	1	5	3
4th March 1898	—	—	—	2
11th "	2	—	—	—
18th "	—	—	—	—
25th "	1	—	—	—

These figures, of course, include all cases among those living in the camps and fields outside the city. Little comment is necessary, as the figures speak for themselves. The sudden drop in the number of cases came in the week ending 24th December. The town was practically empty by the middle of December, only a few who had to make special arrangements for the removal of their valuable property remaining behind till the end of the month.

20,234. Did the camps enjoy immunity from plague?—Almost complete, and this was one of the most striking features of our operations. The largest camp, known as Pothepur, with over 10,000 inhabitants, was not more than 200 yards from the town walls. Yet with the exception of one or two cases, most probably of people with plague in them when they came to live in the camp, it was entirely free from plague.

20,235. Before people were admitted into the camp, and after they had been admitted into your camps, what precautions were taken?—Most careful precautions were taken in the camp under the supervision of Mr. Pratt, Assistant Collector, who was placed in charge of it; all new arrivals were made to bathe their bodies and clothes in disinfecting baths, and there was an inspection of each hut twice daily for plague cases. Our regular camps were almost entirely free from plague from the first, and that, too, at the coldest time of year, when the disease is generally found to be most vigorous in towns.

20,236. Did you find that bad results followed on the emptying of a plague-stricken town?—The plague, of course, spread outside.

20,237. I mean as regards the neighbouring villages?—It spread to them gradually, but to no very great extent. It went on outside for a long time after it was practically extinct in the town. I am of opinion, however, that in the case of Sholapur the plague was not spread so widely under our evacuation system as it would have been had we not gone in for evacuation, and that this will always be the case in similar circumstances. Before we decided on a general evacuation, it was found that a large number of plague-stricken people and their friends were leaving the town and hiding in the villages. In spite of guards placed on all roads, they managed to escape, generally at night; and every morning corpses were found lying on the roads leading from Sholapur and in the surrounding fields. What happened was that as soon as a case occurred in a house, all the inmates at once fled to escape infection and segregation. It was impossible, by merely putting

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guards on the roads and patrolling between them, to stop the people getting away; they would wait till night and creep through the fields and hedges, any where and in any way to get away. Nothing less than a fence round the whole town would have prevented them. Thus many of the sick and contacts, not detected by us, escaped to the villages, while the healthy, as a rule, remained behind. When only a partial evacuation of the worst quarters was being carried out, it was the interest of all the neighbours to help these fugitives to get away, so that their quarters might not be ordered to be evacuated. When complete evacuation is resorted to, there is not, in my opinion, the same danger to surrounding villages; a few more healthy people may take refuge in them, but there is not the same inducement for the infected or contacts to go; they are already undergoing the discomforts of *camp* life, and the segregation camp is not much worse, perhaps rather more comfortable; and it is no one's interest to help them to escape.

20,238. Would you tell us the chief conclusions you formed from your plague experience?—The conclusions which I would beg to submit to the Commission as the result of my experience in Sholapur are as follows:—

(*a.*) The immediate and complete evacuation of all villages, and of towns up to 40,000 or 50,000 inhabitants, when this is considered possible, is the best way of treating an outbreak of plague.

(*b.*) *Before* commencing the evacuation of a large town, complete arrangements should be made, and the necessary staff sent to their posts, for the thorough inspection of all surrounding villages, say, within 30 miles, and for immediately evacuating any village where plague is discovered.

(*c.*) Partial evacuation of towns and villages by clearing out the worst infected quarters only is not recommended where complete evacuation is within the bounds of possibility. It may reduce the mortality and make the disease move slower, but it will not stamp it out.

(*d.*) The system of keeping the inhabitants of an infected town or village to their houses by drawing a cordon round the place is not recommended, and will, it is believed, prove a failure, except in the case of small villages.

20,239. (*Mr. Hewitt.*) Is it the case that before you evacuated any part of the town there had been a large number of cases of plague?—We started by slow evacuation. We began with houses only, and then we went on to quarters. We extended it gradually to small quarters of streets, and then to the whole town. I cannot exactly tell how many cases had occurred while these partial evacuations were going on.

20,240. Did you have contact camps and health camps?—We had.

20,241. Voluntary as well as compulsory?—They were all compulsory.

20,242. What was the largest number of cases, firstly, in the health camp, and, secondly, in the contact camp, at any one time?—I am afraid I cannot say that.

20,243. Can you give any estimate?—We had three or four health camps round the town.

20,244. Can you give us an approximate estimate of the proportion of the 62,000 inhabitants of the town who were in these camps?—I should think about 25,000 at least.

20,245. So that about 35,000 persons went elsewhere?—A great many went to their own lands in the vicinity of the towns. Sholapur is an agricultural town, and cultivation comes close up with it. Anyone with lands and fields would go with their friends and stay in their own fields. We had not any actual check over these small habitations in the fields, though they were always inspected for plague cases, but we could hardly say they were under our control; they were only inspected.

20,246. What proportion of the 62,000 inhabitants of Sholapur went, in your opinion, to other places?—There was a large exodus at the beginning of the plague. I should think about a quarter of the population probably had gone before the plague became bad at all.

20,247. And do you think that these people would have gone, whether you took any measures, or whether you did not?—I expect so. I do not think they could have been stopped. Sholapur is close to the Hyderabad frontier, and a large number fled across the border merely at the prospect of plague restrictions, as they thought in Hyderabad territory they would be outside our control entirely.

20,248. When you advocate complete evacuation of towns up to 40,000 or 50,000 inhabitants, you contemplate the possibility of a certain proportion of the population of such towns flying away into other localities?—Yes, I should think about a quarter. Of course, this is only a rough estimate; but I think that whenever plague appears at a place an exodus always begins at once, and goes on slowly and silently, so that, when it comes to checking the actual houses, you will always find that there are a great many empty.

20,249. Do you think that exodus is due to the fear of the plague, or to the fear of the measures taken to suppress it?—I think the people are afraid of both. I do not think it can be attributed solely to one or the other; I think equally to both.

20,250. Do you find that any particular classes left the town in the early stages of the epidemic?—Such as could travel easily, and had not to stay at home to earn their daily bread, could, of course, go; and those who had houses and friends elsewhere would always go at first.

20,251. Do you think that any measure could be devised which would keep all the people in a town of this sort?—I think it is quite impossible.

20,252. (*Dr. Ruffer.*) Was there a sudden running away when evacuation began?—No, I do not think so. We had arranged quarters for the people outside, and they thought they might as well stay. Those who remained behind had probably something to tie them to the place.

20,253. You said you began general evacuation in the beginning of December?—Yes.

20,254. Can you tell me, week by week, how many people had been evacuated in December?—I cannot tell you.

20,255. Can you tell me approximately whether half the number had been evacuated by the 10th of December?—I should think over half.

20,256. Could you tell me the mortality among the evacuated and the people in the town?—I could not tell you.

20,257. Do you think the mortality was larger in the town than in the evacuation camps?—Much larger in the town; it was extremely heavy; while outside there was hardly any.

20,258. (*Mr. Cumine.*) After all the people had been turned out of the town, did you find it possible to prevent them coming into the town during the day on business, or walking through the town?—We allowed anyone who had property of any value in the town to come in from time to time to open his house and see if everything was right, but they had all to be out in the evening. There was no one allowed in at night.

20,259. What did you do with all the shopkeepers?—They were all arranged in streets in the camp. We had a grain street and a cloth street, and so on. They had all their streets outside in the camps.

20,260. Were the people in the health camps free to go about their duties in the day?—Yes, quite free, there was no restriction.

20,261. Could they go into the town?—They could go into the town generally, but we tried to prevent them going in to any great extent, only there was no absolute prohibition. If anyone wanted to go in he was allowed to go to his house and open it.

20,262. There was a great exodus when the plague first appeared. If Sholapur was attacked again do you think there would be the same exodus, or anything approaching it?—I do not think it would be quite so bad.

20,263. When plague appeared in the town of Sholapur, and as it got towards the Nizam's frontier, did you on each occasion let the Resident of Hyderabad know that plague had appeared near his borders?—I do not think we did our duty exactly in that respect; we gave information afterwards. I think the charge against us on that point is just.

20,264. Though you evacuated this large town on that one occasion do you think it a practicable thing to do to go on evacuating it on every future occasion in which plague may get into the town—a large commercial town like that?—It is not a large commercial town, and I think it was that fact that helped us to evacuate

entirely. It is a great grain distributing centre, and this work can, of course, go on outside the town as well as in the town, but it cannot be called a commercial centre, I think.

20,265. Do you think it practicable to go on evacuating each time?—I think it could be done again; I do not know whether it is advisable, but it could be done. The people have got used to being out and they are quite content to be out. There were discomforts, of course, but there were no serious complaints.

20,266. (*The President.*) I judge that you did not regard partial evacuation as successful?—No.

20,267. This partial evacuation was not commenced, I think, until there was already a considerable amount of plague in the town?—No.

20,268. At the time you were partially evacuating, the people were running away?—Yes.

20,269. You had probably no provision made for those who wished to go away, in the neighbourhood?—We had not a large enough camp.

20,270. But supposing you had effected complete evacuation at the commencement, do you think you could have provided accommodation for this large multitude?—It could have been done. The people generally belong to the poorer classes, and can do with very small accommodation in camp. We gave them generally small triangular huts made of bamboo and cloth stretched over. The great majority of the people were housed in these huts.

Mr. W. T. Morison, I.C.S.

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20,271. Are your measures for detecting cases more perfect now than they were originally?—I have not had any experience of plague work since then.

20,272. In the latter part of your experience had it been improved?—My experience stopped at the end of my time in Sholapur, in January 1898.

20,273. Supposing there was an outbreak again, do you think that the early cases could be more successfully detected than they were before?—I cannot say, I do not think they would. I think that by the end of our campaign at Sholapur we had got everything arranged, and the inhabitants, too, were in more or less training.

20,274. Are you able to tell me whether the cases appeared to be equally severe, or not so severe at the latter part of the epidemic when the numbers were being reduced, compared with what they were at the earlier parts, or when the plague was most prevalent?—They seemed to me equally severe. The average mortality among the number of cases seemed to be as large at the end as at the beginning.

20,275. Therefore, possibly the falling off was not due to diminution in the virulence of the plague itself?—So far as I could say it was not.

(Witness withdrew.)

Mr. N. A. F. Moos called and examined.

Mr. N. A. F. Moos.

20,276. (*The President.*) You are the Director of the Government Observatory at Bombay?—Yes.

20,277. (*Mr. Hewett.*) You have prepared a chart,* have you not?—I have.

20,278. With what object?—In order to see if the mortality curve was in any way influenced by any seasonal factor or combination of factors. My attention was first drawn to it by a letter from Mr. Monteath, the Chief Secretary to Government, who asked me to submit the daily curves of temperature, expecting that these would present some resemblance to the mortality curve. By examination, I found that the vapour pressure curve ran more closely parallel (inversely) to the mortality curve than the heat curve; and it was on those suggestions that I thought that the two factors properly combined might give a resultant curve, fairly coincident with the mortality curve.

20,279. What are the data from which you have prepared the vapour curve?—From Regnault's formula. All the observations were taken at the Kolaba Observatory. From the readings of dry and wet bulb thermometers vapour tension was derived, and from this vapour tension the dew point is obtained from tables, and the dew point then is modified by the difference in the temperature of the air and the temperature of the ground. This would roughly and indirectly measure the ground evaporation, because according to a theory analogous to the theory of exchange in heat, the greater is the amount of vapour in the air, the less would be the evaporation from the ground, and the less the quantity of vapour in air the greater the evaporation from the ground. That which has greater humidity parts with its moisture to the other which has less, and it is on this theory that the tension of moisture in the air would measure indirectly the evaporation from the ground. Unfortunately, in the observatory, no direct observations of the atmometer or evaporometer are available. In the absence of these observations, the only possible approximate way to get the ground evaporation is by combining such factors as measure this evaporation indirectly; and these factors are the dew point, modified by the difference of the temperature of the air and that of the ground.

20,280. Where did you take that temperature?—At the Observatory.

20,281. At what depth below the surface?—Of course there are various depths at which temperatures are taken. For my purpose I have selected five feet below the ground. Temperatures are taken at various depths, from one inch to 12 feet; the maximum depth at which we take the temperature is 12 feet. The reason why I have selected five feet under the ground is this: the diurnal variation due to solar heat at Kolaba does not take effect in the ground beyond a depth of nine inches; the annual variation goes beyond this zone, but does not penetrate beyond a depth of 12 feet; I have therefore selected five feet as not being too shallow nor too deep; and, even taking the observations at other depths, the curve will be more or less analogous to the one which I have shown. Before I arrived at the data I made several trials with different depths and different factors, and the curves were found to be more or less similar. There is a slight difference in the runs, but the reasons of the discrepancies can be easily explained; the general run, however, is almost the same as that submitted in my chart.

20,282. (*Dr. Ruffer.*) Is your method liable to error; what is the percentage of error?—That I really cannot say, but I think that the general run of the curve would not be affected, although possibly the weekly fluctuations might.

20,283. How much do you think it could be affected? Would it be 10 per cent. or one per cent.?—I really cannot answer that question, as in cases of approximation it is difficult to judge exactly; but I do not think it would appreciably differ from the curve submitted.

20,284. Would it be such an error that it would affect your curve much?—No.

20,285. Visibly?—No, not visibly.

20,286. (*Prof. Wright.*) Do you call your curve a climatic curve, or a ground evaporation curve?—Yes, the so-called climatic curve represents approximately a ground evaporation.

20,287. Does your curve express the resultant of four different series of data: one, the temperature of the air; secondly, the temperature of the ground; thirdly, the amount of moisture in the air; and, fourthly, the amount of moisture in the ground? Are all those four factors taken into account?—Yes. The first three would indirectly represent the amount of variation in the ground evaporation.

20,288. I suppose the higher the temperature in the ground the more the moisture, and the greater would be the vapour-tension in the ground?—The greater the tension.

20,289. And in the case of the air I suppose that the less the amount of contained moisture and the higher the temperature, the greater would be the tendency to take up vapour from the ground?—Other factors remaining the same, the less the vapour in the air, and the higher the temperature of the air, the greater will be the tendency for the air to take up moisture from the ground. It is a question of relative tension. If the tension in the air is greater than that in the ground the air would part with its moisture to the ground, and *vice versâ*.

20,290. Your curve, then, represents the balance between the two tensions—the tension of moisture in the air and the tension of moisture in the ground?—

* *See* App. No. LVIII. in this Volume; the charts and notes put in by Mr. Moos are published with notes regarding them made by Dr. A. Buchan, LL.D., F.R.S., Secretary to the Meteorological Society for Scotland.

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Yes, it measures the tension of the vapour in the ground, as determined indirectly from the tension of vapour in air.

20,291. How is the vapour-tension of the ground determined?—I have not been able to determine, as already stated, the absolute amount of moisture in the ground.

20,292. Is there no method, by which it can be directly determined?—There is; by observations with atmometers and evaporometers, but we have not got these instruments.

20,293. What do you substitute for them?—By a mathematical reasoning, knowing that the vapour-tension of the air varies inversely as the vapour-tension of the ground, the former, modified to the temperature of ground, would approximately and indirectly measure ground evaporation.

20,294. You mean to say that the tension of air would vary inversely with vapour-tension of the ground if it were freely exchanging vapour with the ground?—Quite so; the theory of exchange in heat may be analogously applied to the moisture too.

20,295. But the air is not freely exchanging vapour with the soil five feet below the surface?—The tension of the vapour in the two are relatively connected.

20,296. Why did you select this depth of five feet? Did you select it because you found the curve that you obtained in this way agreed with the curve of the mortality?—Yes. The average run here is much more close than when the other depths are taken, but the difference only lies in the weekly fluctuations, and not in the general run of the curve.

20,297. You said the seasonable variation ceased to make itself felt at 12 feet below the surface?—Yes.

20,298. You *took* as the basis of your curve the observation made at five feet below the surface, but I understand that your curve would have come out quite the same if you had employed thermometrical readings which had been taken at other depths below the surface?—Yes. The broad undulations correspond in each case, under certain limits.

20,299. But the small undulations?—They do not quite correspond.

20,300. Then did you choose the readings obtained at a depth of five feet, because the curve which was based upon these readings coincided most closely to the curve of the mortality?—Yes.

20,301. (*The President.*) How do you state the relationship between the surface evaporation, and the mortality rate from plague?—Whenever the ground evaporation was a maximum, the mortality was a maximum.

20,302. You have handed in a written statement here, which embodies all your views. I believe they are all contained in this paper?—Yes (*see* Question No. 20,309).

20,303. (*Prof. Wright.*) You think the mortality is greatest when the ground is giving off most vapour to the air?—Provided it is contaminated, because that is the basis on which I go. Under ordinary circumstances, in normal years, this seasonal increase in ground evaporation would be innocuous.

20,304. Does that mean that the mortality is greatest when the upper surface of the earth is most saturated with moisture?—It goes without saying, because if there is evaporation from the ground, there must be moisture.

20,305. But would the upper surface of the ground be most saturated with moisture whenever vapour was being given off from the ground; are there not two factors which determine the moisture of the surface of the ground: first, the deposition of dew from the air, and secondly, the moisture coming up from below?—I may say that the moisture of the air is mainly derived from the sea, but the moisture of the ground depends on the geological structure, and the environments of the place, as well as local causes: *e.g.*, the water supply, the proximity of lakes or tanks, and the free and profuse use of water, under which circumstances it is possible that the surface to a depth of five to ten feet may be thoroughly saturated with water.

20,306. Would not the moisture of the surface of the ground be more influenced by the deposition of dew than it would by the evaporation of vapour from the ground below?—Not so much; the inherent moisture of the ground would not be affected, specially in the deeper parts of the ground, by the deposition of dew.

20,307. But would not the moisture of the surface of the ground be most influenced by dew being deposited on it?—Just the very surface.

20,308. (*The President.*) As far as I understand, it appears that the more favourable the conditions for the virus to rise from the ground into the air, the greater is the mortality from plague?—Yes.

20,309. Will you put in all these papers, showing the data?—Yes. They are as follows:—

"The object with which the following inquiry was undertaken was to find whether any meteorological factor or combination of factors had any direct or indirect influence on the mortality of the city from week to week and month to month.

"At the outset it was noticed that no very abnormal feature could be detected in the various meteorological factors of the plague years, as compared with those of past years, except in one single factor, that of ground temperature.

"The yearly value of temperature fluctuated irregularly for about 40 years past about 83° Fahr. It, however, began to rise at all depths, feebly but steadily, from the year 1888, and the figures for 1896-97 and 1898 are exceptionally abnormal, *vide* table attached (Temperature of Air and Ground, 1846-98).*

"The first step, therefore, was to see whether any combination of this factor with other factors like air temperature, 'moisture,' &c. could give a curve which in its general run coincided with the mortality curve. After several trials it was seen that temperature of the air, temperature of evaporation, and temperature of ground five feet below the surface, if combined in a certain way, gave a curve which ran strikingly parallel to the mortality curve, and the principal, as well as the subordinate, maxima and minima points of which were coincident.

"The coincidence cannot be a mere accident for such a long period as three years; and it may be presumed, therefore, that some sort of relation does exist between the two as indicated.

"The nearest, though not *absolutely correct physical interpretation*, of the combination of factors adopted, is ground evaporation, and the curve so delineated may be accepted as representing ground evaporation.

"The question of importance in the above comparison is not about the arbitrary selection of a depth of five feet below ground surface, the selection of which will be presently explained; but whether the interpretation of the combination to mean ground evaporation could be justified. It was with a view to examine this point, that combinations were made in several ways by which the nearest approach to ground evaporation could be represented. The ground evaporation may, approximately, be represented by the formula:—

$$F = f - c\,(t_e - t_a) \times \frac{P - f}{30}$$

where t_e is the temperature of the ground at any given depth, t_a the temperature of the air, F and f being the tension of vapour at the two temperatures, and P the barometric pressure.

"The curve, however, has been drawn from figures given by $\left[D - (T_e - T_a)\right]$ where D represents the dew point obtained from a similar formula as given above. It may be noted that the curves given by either method are similar and identical. The latter is preferred because the calculations are less troublesome, and give no extra labour, as the factors D and $T_e - T_a$ are daily obtained in the observatory for other purposes.

"The selection of the arbitrary depth, 5 feet, is obvious now from the treatment adopted. In the expression $D - (T_e - T_a)$, if we take the temperature of the ground on the surface, which is almost equal to that of air above, $T_e - T_a = 0$, and the expression becomes D, that is, the curve would represent dew point only. If we go 12 feet below ground, where the temperature is constant throughout the year, and does not vary with solar heat, the fluctuations virtually represent $(D + T_a - \text{constant})$. In both these extreme cases, therefore, the ground temperature will not be represented in the fluctuations of the curve. In order, therefore, to bring the ground factor effectively in the expression, the selection of a depth of 5 feet midway between the two extreme cases was deemed essential. Practically the temperature at 5 feet below ground, therefore, may

* *See* App. No. LVIII. in this Volume.

be taken to represent the integral effect of temperature at various depths from 0 to 12 feet, or the maximum effect.

"In conclusion, I beg expressly to say that I do not assert that the plague mortality, after inception of the germs on the soil, is wholly dependent upon seasonable causes. Obviously that cannot be, as other factors, known and unknown, must also affect the mortality of a great city like this. But I do wish to say that a *primâ facie* case has been made out, to show that the seasonable factor, as measuring ground evaporation, is one of the principal causes which influence the rate of mortality, and which, if conclusively proved, would have an important bearing on the whole question. It therefore justifies further investigation in that direction, and with that view I am strongly of opinion, that thermometric stations should be established in different parts of Bombay, specially in the affected districts like Byculla and Mandvi, &c., to enable ground and air temperatures and absolute evaporation results to be obtained directly, and I have no doubt that important side light would be thrown on the question of propogation of the disease. The indications of temperature, &c., at Kolaba, which is situated on high and rocky ground, cannot exactly measure the important factors under discussion which may be prevalent in the actual plague centres, and, therefore, the proposed stations are absolutely essential in the inquiry."

Mr. N. A. F. Moos.

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(Witness withdrew.)

Mr. A. G. MACKENZIE called and examined.

Mr. A. G. Mackenzie.

20,310. (*The President.*) You are Superintendent of one of the jails here, I believe?—Yes; I am Superintendent of H.M. Common Prison, Bombay.* The information I shall give you will be with regard to the numbers in the prison, the number of those inoculated, and how long they remained afterwards.

20,311. (*Prof. Wright.*) Perhaps you will tell us how the prisoners were selected for inoculation?—I selected them myself. The first inoculation took place on the 1st January, 1898. There were 199 prisoners selected out of a population of 399, leaving 200 uninoculated, about one half.

20,312. On what principles were prisoners selected for inoculation?—On no principle whatever. I formed the prisoners up and selected a few here and there, and formed them into batches. It was an experiment, and half the prisoners were inoculated and the other half were not, and we wanted to see the result.

20,313. Do you think the prisoners who were inoculated differed in any respect from the prisoners who were not inoculated?—Beyond a doubt; I think the inoculated were protected.

20,314. I mean did the inoculated differ in age or physique from the uninoculated?—No, they were formed in a line and I simply took them out here and there. I made no particular choice.

20,315. Were the inoculated persons treated differently from the uninoculated?—No, except that they were sick for 24 or 36 hours, and had to be relieved from their labour.

20,316. During these 24 hours, were the uninoculated exposed to different conditions from the inoculated?—No, I made no difference whatever. They were all placed in their cells.

20,317. What were the results?—The inoculation took place on the 1st of January, 1898. Prior to that there were three cases of plague in the jail, and it was in consequence of that that the prisoners were inoculated. Two of those three cases were attacked on the 31st December, and the third on the day of inoculation, in the early morning, and those three died. After the inoculation there were 17 attacks up to the 29th July, 1898, among the uninoculated. There were only three attacked among the inoculated and they all recovered. Out of the 17 uninoculated, nine died and eight recovered.

20,318. How long were the inoculated and uninoculated under observation? I understand that some of the prisoners obtained their discharge soon after the inoculation had taken place?—My jail may be called a migratory prison; they are all short termers, in to-day and out to-morrow. At the end of July there were about five men left out of the 400; the others had all gone and an entirely new population was in the jail, short-term prisoners, some a few days, some one month, and some two months, and so on, and perhaps a few up to 12 months, say half a dozen.

20,319. Were the numbers of the uninoculated increased by fresh prisoners coming in?—Beyond a doubt, but I am only speaking with regard to the population which was in the jail on the day of inoculation.

20,320. You have confined your statistics to what happened amongst those?—Yes; the other men did not come under my observation; there was no need for it.

20,321. Among the 200 who were uninoculated 17 cases occurred?—Yes, up to July.

20,322. Have you any information about the subsequent fate of those who left the the prison?—None whatever.

20,323. We have had it in evidence that there were two suspicious cases of plague admitted to the Parel Hospital who had been inoculated in your jail. It was doubtful whether these particular patients had mild plague or whether they had mumps; do you know anything about these cases?—No, I do not. I know that three prisoners have been recently attacked, two during January, with plague.

20,324. (*Mr. Ruffer.*) Inoculated or uninoculated?—Uninoculated.

20,325. (*Prof. Wright.*) Have all the inoculated now left your prison?—They have all left except five.

20,326. Can you give us the dates on which the inoculated persons left?—Yes, I can give you the statement, and also a statement showing how long those who were not inoculated were in the prison and when they were discharged.*

20,327. How long did the epidemic of plague last?—Up to the 29th July.

20,328. You mean that there were dropping cases up to this time?—Yes, the 29th July was the last. The cases prior to that were on the 29th June, 18th March, 28th February, 10th February, 2nd February, and so. They were quite sporadic.

20,329. Were any of the prisoners seriously ill after inoculation?—No, they all recovered within 36 hours or so.

20,330. Do you think the amount of reaction which you got in the prisoners was fairly equal?—Some suffered more than others, but all about the same time, from about 24 to 36 hours. Some suffered very acutely, or, at all events, their complaints were greater. They may have been less able to bear the pain, but they appeared to suffer more.

20,331. (*Dr. Ruffer.*) Can you prepare a table giving the name of each prisoner, the age of each prisoner, the date of inoculation, the date of entrance into the jail, the date of exit from the jail, the number of the cell in which he got the attack, the date of the attack, and the result of the attack?—I put in a statement* which gives the particulars required; there is, however, no record of the particular spot where each attack took place. All the cases occurred in the quadrangle on the south side of the prison, the first four attacks being in a spot in the south-west corner of the corner of the barracks—a large barrack where the prisoners sleep in association.

20,332. (*Mr Cumine.*) To what extent were the attacks among the uninoculated due to the mere accident of their having slept in a cell where there had been a previously infected person? I believe there was some plague in the jail before you performed the inoculations?—Yes, three cases in December.

20,333. Do you know in what cells those three cases lay ill?—Yes; they were all in what we call the lower barracks, not in cells—the barrack is a large building well ventilated.

20,334. With regard to the uninoculated persons who were attacked after the inoculations, could you tell us how many of them slept in that barrack in which the three people slept who were attacked and died before the inoculation?—Yes. To begin with, it is a large

* *See* Appendices Nos. LIX., A. and B., in this Volume.

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barrack. They were all three attacked, I think, on the lower floor and in a particular spot. It is a singular fact that attacks took place on the south-western side of the barrack more than in any other part of the jail. I cannot account for it because the whole jail is clean and dry, but such is the fact, there were four cases here.

20,335. Had the three persons who had been attacked before the inoculation been sleeping in that spot?—I think I can find that out for you. (Note by witness on correcting proof of his evidence:—I find that they had been, and I then, on the 7th January, turned the whole of the convicts out of the buildings and made them sleep in the open; no case then occurred till the 15th January 1898.)

20,336. When uninoculated persons sleeping in that spot were attacked, were the inoculated persons sleeping there also?—Yes, there was never separation made at all.

20,337. Were they sleeping in that particular part of the barrack?—Yes. The men are shifted about indiscriminately. Prisoners are never allowed to sleep in one particular cell or one particular part of the barrack; that is our system of discipline. If a prisoner were kept in the same spot he could carry out his measures for escaping day after day, and so we shift them about.

20,338. As a fact, can you say that in this particular spot which appeared to be infected there were inoculated as well as uninoculated people sleeping after the inoculations?—Beyond a doubt, but they were all turned out and the building vacated on the 7th January.

20,339. Did you find that the inoculated people sleeping on the spot were attacked?—All the facts are to be obtained from my register. No inoculated man was attacked there; as a matter of fact the place was vacated as I have previously stated seven days after the prisoners were inoculated.

20,340. (*The President.*) When a case occurred, how did you dispose of it?—I sent cases to the Plague Hospital.

20,341. How did you treat the cells?—The cells were disinfected and the clothing destroyed, and no prisoners were allowed to be locked up in that locality for several days—10 or 15 days. I kept those cells as vacant as possible, but, unfortunately, at the time the jail was very much over crowded. The accommodation was for 160 prisoners and we had nearly 400, so it was terribly overcrowded. It is astonishing that the plague did not spread further in the jail, but I believe that the reason it did not was on account of the measures which I took. I burned a tremendous lot of quicklime, put it on boiling all over the place, roof, floors, the whole of the quadrangle and ground, and every corner, and I kept it up for several days. I am of opinion that I prevented it developing into an epidemic and that I destroyed the plague altogether in the jail ultimately.

20,342. I understood you to say that in a certain part of the jail cases did take place?—They were sporadic cases; it could *not* be called an epidemic.

20,343. Did you each time disinfect that part especially?—Each time.

20,344. How did you disinfect it?—With quicklime in a boiling state and carbolic dilute.

20,345. How was it diluted?—The Medical Officer prepared the prescription and it was mixed accordingly and thrown on.

20,346. Obviously, that part had not been properly disinfected?—I cannot account for it.

(Witness withdrew.)

Mr. C. N. Hall.

Mr. C. N. HALL called and examined.

20,347. (*The President.*) You are Superintendent of Her Majesty's House of Correction, Byculla?—Yes.

20,348. (*Prof. Wright.*) You superintended the inoculations in January 1897?—Yes.

20,349. How many cases of plague were there before inoculations were resorted to?—I cannot give you that information.

20,350. Were you present when prisoners were selected for inoculation?—There was no selection; it was voluntary. The prisoners were asked to come forward if they wished to be inoculated and those who came forward were inoculated.

20,351. How many were inoculated?—153.

20,352. How many were left uninoculated?—185.

20,353. Were these prisoners all in contact with each other after inoculation?—Yes.

20,354. Did the prisoners who were inoculated differ in any way from the uninoculated in age or health?—They were about the same.

20,355. Did they follow different occupations?—No, all one occupation, *i.e.* intra-mural industries.

20,356. How do you know how many cases occurred among the inoculated and among the uninoculated?—I can give you that information, but I may mention that the Assistant Surgeon of that prison is here, and he will give you all information. The inoculated and uninoculated were all treated in the same way. There was one point of difference, viz.: that those who were inoculated did not work the next day. They said the fever was so great that they could not work, and they were excused. There was no difference in diet or anything else.

20,357. Were the uninoculated kept in a part of the jail where the plague had occurred before near the original plague cases?—No. After the plague occurred inoculated and uninoculated were all moved into work sheds; the whole body of prisoners was taken out of the cells.

20,358. (*Dr. Ruffer.*) Could you put in a table showing on which day the plague began, the names and ages of all prisoners, the date of entrance in the jail, the date of inoculation, the date of discharge, and the date of attack and the result?—This is with Mr. King's evidence.*

* *See* App. No. LX. in this Volume.

(Witness withdrew.)

Assist.-Surg. A. King.

Assistant Surgeon A. KING called and examined.

20,359. (*The President.*) Are you the Assistant Surgeon of Her Majesty's House of Correction, Byculla?—Yes.

20,360. (*Prof. Wright*) Can you give us any facts about the inoculations which were done in the Byculla Jail in January 1897?—Yes.

20,361. Were you present when the prisoners were selected for inoculation?—Yes.

20,362. Is it your opinion there was no difference between those who were inoculated and those left uninoculated?—There was no difference at all.

20,363. And is it your opinion that the inoculated and the uninoculated were treated in exactly the same way afterwards?—Exactly, except that they did not do any work the next day or so.

20,364. Did any of the prisoners suffer severely from the inoculations?—Yes; a number of them suffered very severely.

20,365. Were there any among the inoculated who did not react to the inoculations?—Yes; they had no fever after the inoculation.

20,366. Can you trace whether the inoculated who subsequently got plague had or had not a severe reaction at the time of inoculation?—There were five men attacked with plague after inoculation out of which three died. Of those who recovered one had been inoculated once and the other had been inoculated twice.

20,367. Did all these five occur within a few days after the inoculation?—The inoculation was done at 3·30 in the evening of the 30th. Three of them got plague about six or seven o'clock the same evening. One case occurred on the 1st February and the other on the 6th February.

20,368. Then there was an interval in two cases between the inoculation fever and the attack of plague?—Yes.

20,369. Can you find out in those cases whether the inoculation fever was high or whether it was very insignificant?—In one case Dr. Haffkine thought it was the reaction fever, that is, the one which occurred on the 1st February, but the other case he thought was plague.

20,370. Had the inoculation fever been high or insignificant in the second case?—It was 102 or 103—the man had glandular swelling.

20,371. Do you mean he had glandular swellings when attacked with plague or after inoculation?—I think glandular swellings due to plague symptoms, not after the inoculation.

20,372. What interval was there between that man's inoculation and the attack of plague?—The first inoculation was done on the 30th January, and the second on the 2nd February; he got plague on the 6th February.

20,373. He had been twice inoculated?—Yes.

20,374. I suppose that the temperature which he had on the 3rd was due to his inoculation?—Yes.

20,375. Do you know how high the temperature was?—100·8.

20,376. Can you tell us what was his temperature after his first inoculation?—No, because I had been inoculated and was seedy myself at the time.

20,377. Will you look through the records and ascertain whether you have any data to enable us to decide whether the prisoners who reacted were absolutely protected, and whether there was a defect in reaction in those prisoners afterwards attacked with plague, stating also the dates on which the inoculated prisoners left the House of Correction?—I can give you a very accurate statement with regard to the second inoculation, done in 1898, but with regard to the first I am afraid I shall not be able to give you the data exactly, because I was inoculated and prevented from doing my work.*

20,378. (*Dr. Ruffer.*) Were the same prisoners present at the second inoculation as were present at the first?—A few of them.

20,379. Where were the buboes situated in the three cases inoculated by M. Haffkine, which were classed as having plague when inoculated?—Prisoner, No. 672, Keshav Umishankar, left inguinal and femoral glands. Prisoner No. 1356, Abdool Karim Goolam Hussain, left axillary glands, subsequently the whole lymphatic chain, as far as the wrist, was swollen and painful, including the left mammary. Prisoner, No. 1222, Govind Pandu, left axillary glands.

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20,380. Can you give us ages of all prisoners attacked?—Yes.

No.	Prisoner's No.	Name.	Years of Age
		1897.	
1	977	Bhiwa Bhagoo	24
2	1093	Rama Govind	22
3	1359	Narayan Dhondu	25
4	1349	Adamji Alibhai	28
5	1235	Khatow Lakhmidas	26
6	1094	Ramvalab Rampartab	22
7	1247	Antone Salvadore	25
8	1272	Balkhrishna Makadu	27
9	1242	Gannoo Baloo	24
10	1362	Syed Jonas Ali	27
11	1276	Hossein Mahomed	25
12	1312	Walli Chand	30
13	1310	Vishram Jairam	50
14	1129	Raoji Jothu Powar	25
15	1144	Jiva Virchand	24
16	1224	Auna Vishnu	23
17	1229	Gannu Esso	32
18	672	Keshav Umishankar	24
19	1356	Abdul K. G. Hussain	38
20	832	Rama Lakshman	25
21	1261	Kallu Bhimba	35
22	1222	Govind Pandu	26
23	1336	Gunpat Babaji	26
24	1252	Jay Mohan Ganesh	25
25	988	Mahomed Hossein	30
26	1238	Babuji Sambhaji	28
27	1166	Mawji Bhowan	27
28	1297	Dhondu Sulkia	32
29	1332	Kalloo Luximon	26
30	746	Gangu Dongersey	50
31	1267	Baloo Krishna	30
32	993	Mamu Ibrahim	52
33	1366	Shamrao Sitaram	27
		1898.	
1	346	Sulleiman Allarakhia	25
2	230	Marotti Babuji	20
3	303	Gokul Dipchand	27

There were attacked in the Workhouse two inmates, viz., Robert Shepherd, 27 years of age, inoculated, and Michael Curwen, 32, not inoculated.

* *See* App. No. LX. in this Volume.

(Witness withdrew.)

Major H. P. Dimmock, I.M.S., called and examined.

Major H. P. Dimmock, I.M.S.

20,381. (*The President.*) You are a Doctor of Medicine of Durham University?—Yes.

20,382. And you are in the Indian Medical Service, and have had a large experience of plague in Bombay?—Yes.

20,383. I understand you were a member of the Plague Committee?—Yes; I was appointed in March 1897.

20,384. Will you give us your views as to how the bacillus produces plague?—By entry, primarily, I think, through the distal lymphatics.

20,385. What form does it generally produce then?—The bubonic is the most common, of course the development of buboes through the infection of the distal lymphatics.

20,386. The bacillus may infect through other channels, may it not?—Yes. I think it may effect entry through the mucous membrane, and probably through open sores of the skin, and also through the lungs.

20,387. What part of the gastro-intestinal canal do you think the bacillus enters?—I think it may be passed through the mouth and also, possibly, through the anus, because the natives use ablutions to a considerable extent, and it is possible that if there is any excoriation about the mucous membrance of the anus, infection of the lymphatics may take place in that region.

20,388. With regard to mouth infection, do you think the absorption takes place actually through the mouth surface?—I think so, in some cases. It is difficult to explain how it is that one gets infection of the glands in that region Then there is the abdominal type of the disease, which must necessarily, I think, be the result of infection directly through the gastro-intestinal canal.

20,389. How is it introduced into the gastro-intestinal canal?—I suppose it is swallowed with food or liquid.

20,390. Have you any knowledge of the influence of the gastric juice upon the bacillus entering in that way?—Not from bacteriological knowledge.

20,391. From any source of knowledge?—I could not say that I have made any practical experiments with regard to the gastric juice.

20,392. What led you to say that it may be passed down as far as the stomach and be absorbed through the gastro-intestinal canal?—Simply from my clinical experience.

20,393. Of what kind?—Inference from the method of development of other diseases, such as typhoid fever and the general symptoms of the abdominal type, there being no evidence to show how the bacillus can have penetrated the system except through the intestinal canal.

20,394. I think you have seen some cases where you suspected that the nasal mucous membrane was the absorbing surface?—I had a very interesting experience before I was placed on the Plague Committee. A group of Parsees came in from Thana, and the children were

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suffering from nasal catarrh of a most severe type. The symptoms were, apparently, very acute—coryza, with a high temperature. There was no glandular enlargement in the early stages, but, subsequently, the mucous membrane of the nose and of the pharynx swelled up to a tremendous degree. Eventually, the lymphoid tissue became infected in the same way and the patient apparently died rather suddenly, of suffocation. Within three or four days—in the severe cases—I took three of the children to Professor Haffkine's laboratory, and he investigated the cases most carefully, and finally decided that he could find no evidence of their being plague. At first I thought they were some peculiar cases of diphtheria, but diphtheria is not very common. It does occur during the rainy season, but even then it is not very common. The cases then passed out of my sight—they came to the out-patient department of my hospital and passed out of my sight and went to reside in Mazagaon. From the Health Officer, Dr. Weir, I understand that they set up a very severe epidemic in that region, that they were a focus of a severe epidemic of plague in Mazagaon.

20,395. How many cases did you see?—I saw four.

20,396. In one family?—Yes.

20,397. Did you trace the source of infection?—They came from Thana.

20,398. Was there plague there at that time?—Yes.

20,399. Have you any evidence of any direct contact or relationship?—There were other similar cases occurring in the same house and also cases of plague.

20,400. The important point appears to be that these cases communicated plague to some others?—Yes, and they came from a plague infected centre.

20,401. I think you said that Professor Haffkine did not find the plague bacillus?—He found no plague bacillus. He investigated the blood and the discharge from the nose.

20,402. Have you observed any cases in which direct inoculation of plague could be proved?—We have had one case in which we could positively say there was inoculation, and that was one of the Roman Catholic Sisters at the Parel Hospital, Sister Elizabeth. Her's was evidently a case of auto-inoculation through a pimple or small boil; there was pain and swelling in the region of the boil. In other cases I have seen bullæ formed evidently at the site of inoculation.

20,403. Why evidently?—Because the general symptoms of plague developed afterwards, and because the glands in connection with the distal lymphatics of that region were inoculated.

20,404. From the cases which you have observed, will you give us the usual symptoms of plague?—The symtoms, of course, depend upon the region of inoculation. Where it is through the lymphatic system we get the bubonic form, which is the most common, of course. There are statistics in the two reports* of the Plague Committee, giving the proportions of the bubonic cases in the various hospitals. Some have a greater proportion than others. Then there is the infection direct into the blood-stream, the septicæmic form. These cases are not so frequent, but it is evident that they do occur, because cases have been met with, and I have seen them myself in the hospitals, in which the symptoms are those of general sapræmia. In fact, I think, all these classes of the disease very closely resemble septicæmia, as we understand it, both in the pathology and development of the symptoms. Then there is the other infection through the lungs which produces a distinct form of lobular pneumonia. The first case which came under my notice was the late Dr. Manser, whom I attended in association with Dr. Childe.

20,405. In what respect is it a distinct form of lobular pneumonia?—I mean it is unusual to find lobular pneumonia occurring primarily in a healthy adult. The lobules could be percussed out.

20,406. What is the character of the sputum?—It is sanguineous, of a peculiarly watery consistence, and contains a pure culture of bacillus. You simply have to stain it and put it under the microscope and you can see crowds of the bacillus quite plainly.

20,407. Now with regard to the symptoms?—I have mentioned the following in my précis of evidence:—(*a.*) Pyrexia, 103° to 107° by third day. Toxæmia more marked, with onset of pyrexia. Glands early enlarged, acutely tender, painful, (femoral, inguinal, cervical, axillary). Great nervous prostration in many cases. Pulse soft, quick, small, compressible. Delirium often violent. Vomiting, sometimes severe; silvery tongue characteristic; constipation. Dusky congestion of skin and conjunctivæ; appearance of face characteristic. Lethargy. Death usually sudden from syncope; cases vary in severity; fatal in about five days; recovery by long convalescence. Later cellulitis around glands and suppuration in a large proportion. (*b.*) Pyrexia high; rapid asthenia fatal in a few hours up to two days; always fatal. (*c.*) Lobular pneumonia; pyrexia not very high; toxæmia marked; rapid asthenia. (*d.*) Choleraic form.—No pyrexia; extreme collapse: diarrhœa; no cramps; death in a few hours. Peritonitic form.—Great and early distension of abdomen; dusky appearance; marked toxæmia and asthenia rapid and marked. Both forms always fatal. Direct infection of lymphatics in majority of cases; development of toxine in glands and discharge of same into blood; bacilli frequently not detected in blood. In septicæmic form organisms pass directly into blood; toxines and bacilli develop in great intensity. In pneumonic form toxines manufactured in air cells and absorbed by capillaries and lymphatics.

20,408. What do you say about hospital mortality?—The general mortality was 65 per cent. I take that from the general results of our report. In cases without buboes the mortality was about 75 per cent., and in treated cases 41 per cent.

20,409. I suppose that has come under your own observation?—As an administrative officer I simply observed the general results of the hospital. I was constantly going through the hospital.

20,410. This is one out of a great number of similar statements in that† report?—Yes; it is one large Plague Hospital.

20,411. Then it does not show generally what the hospital mortality is?—I have taken it—the figures of the hospital—as representative of the general mortality.

20,412. Will you give us your views as to the method of infection?—It is by direct infection of the lymphatics in the majority of cases, generally from a plague patient. In the large proportion of cases, I think, human beings are the carriers of the disease to human beings. In certain instances, there is no doubt that rats will communicate the disease, and diseased rats may possibly start an epidemic. I am almost inclined to think that rats were the original cause of the epidemic in Bombay. I have a letter from a large firm, Messrs. Ralli Brothers, dated 11th September, 1896. It is a report to the Health Officer of the Bombay Municipality. They state that they had 13 fatal cases of fever among their native employés and coolies who were working in the godowns at the Ryan Market, Frere Road, which is close to the docks. That was on the 11th September, 1896. There was evidence of plague previous to that.

20,413. How does that bear upon the introduction of plague into Bombay?—It is an inference from those cases. Before those coolies were attacked, large numbers of rats were found dead in the go downs.

20,414. That was in September?—Yes.

20,415. But plague began here in July; therefore, this does not bear upon the introduction of plague?—It is merely an inference.

20,416. What definite evidence have you that rats may convey the plague?—I have given a few examples in my précis. Frequently cases of plague developed in houses, and when the houses were searched dead rats were found. In another instance from those quoted in the précis, in a house in the Fort the residents reported that rats were dying in the house. We recommended them to evacuate that house and have it thoroughly overhauled. They were Europeans and they did not do so. A few days afterwards some of the servants were attacked with the plague, and a few days after that one or two of the Europeans were attacked with plague.

20,417. Can you exclude human conveyance in that case?—No.

* *See* Appendices Nos. XIII. and XIV. in Vol. I. of the Commission's Proceedings.

† "Report on the Bubonic Plague in Bombay, 1896-97:" by Brigadier-General W. F. Gatacre, C.B., D.S.O., Chairman of the Plague Committee.

20,418. Have you anything which absolutely shows that rats communicate or convey the disease?—The only definite case is that of the servant boy, a Goanese who removed a dead rat from the floor and burnt it; he was attacked with plague four days afterwards.

20,419. Might he not also have come in contact with a human subject?—Yes, he might.

20,420. Have you anything more definite?—No; one has nothing really definite.

20,421. So far as human conduction is concerned, what are the most favourable conditions for it?—Overcrowding in the small insanitary rooms in which the natives live. That is the primary cause, I think.

20,422. Did the people suffer most who lived on the ground floor or who lived on the upper floor?—On the ground floor.

20,423. Do you know whether any other animals besides rats may be infected with plague?—Cats have been found to be affected.

20,424. What was the evidence with regard to cats?—Dr. Sticker found the bacillus in cats. The cats were found suffering in the Phatak Wadi (Market Section). They were sent to Professor Sticker who found the plague bacilli.

20,425. What were the symptoms of plague in those cats?—The cervical glands are mostly affected; they are enormously swollen. There is œdema in the mucous membrane of the mouth, the throat, the pharynx, and they died of suffocation. They probably got it from killing infected rats.

20,426. Have you known other animals to be affected?—I have not met with instances of any other animals.

20,427. How long do you think a patient who has recovered from plague may remain a source of danger?—That has always been a very difficult point with me. When we were working on the Plague Committee it was a very important consideration so far as I was concerned, with regard to convalescent patients. I considered six weeks or two months ought to elapse before the plague patient was allowed to mix with people, but I have never been able to obtain evidence—although I have tried—as to whether convalescents would give rise to infection.

20,428. It is pure supposition?—I will not say it is supposition; I could not say it has not actually occurred.

20,429. Can you say it has?—I cannot say it has, but I should think it must be probable; they may be compared to contacts, and should, therefore, be segregated for a certain time. I am inclined to think that some epidemics at a distance, which have been hitherto unexplained, may have originated from convalescents.

20,430. What are your views as to disinfection?—I think it is effective if it is possible to carry it out entirely. If an infected room is thoroughly disinfected, I think that you may certainly be able to dispel the disease.

20,431. Have you any cases in which a room thoroughly disinfected has been reoccupied and plague occurred afterwards in that room or in that house?—There was an epidemic in Koli Wadi. The total number of attacks was 16 from February 21st to February 29th 1898. On the 17th March the whole of Koli Wadi was vacated.

20,432. Is that a locality?—Yes, a collection of houses where the fishermen live. A Koli is a fisherman. The evicts were sent to the Wari Bandar Camp for 10 days, and the whole of the district was then thoroughly disinfected and the roofs all opened out. There was no case afterwards for six months, although it was reoccupied.

20,433. How long after evacuation was it reoccupied?—It was reoccupied after 10 days.

20,434. There were several things done here; can you distinguish chemical disinfection and disinfection by the mere access of air and light? Have you any instances in which mere chemical disinfection was resorted to?—In houses with stone floors it has been noted. One Parsee chawl, Lalbag in Parel, was thoroughly disinfected by chemical disinfection. It was a good chawl with stone floors. The people reoccupied it under the same conditions that they had occupied it before and the disease did not occur.

20,435. What disinfectant was used?—Perchloride of mercury, one in 1,000.

20,436. How many cases of plague had there been in the chawl before?—I do not remember the exact figures.

20,437. Do you recollect whether it was a large or a small number?—I suppose about eight or 10 out of about 300 people.

20,438. Each chawl is a separate building, I suppose?—Yes.

20,439. Have you any instances in which houses or rooms have become reinfected after disinfection?—I am afraid a considerable number of the houses were reinfected.

20,440. Have you any evidence in which evacuation of houses appears to have been beneficial?—We have had many instances where evacuation has stopped plague.

20,441. Which of these measures which we have been talking about appears to be most effective in your experience?—I think there is nothing so effective as evacuation. Its effect is immediate, as I think I have shown by the statistics of the Wari Bandar contacts.

20,442. Perhaps you will put that statement in?—Yes, it is as follows:—

STATISTICS of the WARI BANDAR CONTACT SEGREGATION CAMP relating to the period from 1st January 1898 to 30th April 1898:

Total number of contacts admitted	5,790
Average daily admission	48·25
Average weekly population	2196·1
Average daily population	313·7
Maximum number of contacts in camp, on 5th March 1898	1,060
Total number of cases that developed plague	148
Percentage of plague cases over the number admitted	2·55

Out of these 148 cases of plague—

there developed symptoms	on the day of admission			46
,, ,,	1st	,, after	,,	35
,, ,,	2nd	,, ,,	,,	19
,, ,,	3rd	,, ,,	,,	16
,, ,,	4th	,, ,,	,,	11
,, ,,	5th	,, ,,	,,	10
,, ,,	6th	,, ,,	,,	7
R.C. ,, ,,	7th	,, ,,	,,	1
R.C. ,, ,,	9th	,, ,,	,,	1
R.C. ,, ,,	12th	,, ,,	,,	2
		Total		148

The cases marked as "R. C." were amongst the re-contacts. They were in contact with a plague case occurring in the camp and were segregated for a fresh period of seven days. The period of segregation was at first 14 days, then ten days, and finally seven days, except in the cases of re-contacts.

20,443. Were you occupied in plague work here at the commencement of the epidemic?—Not altogether from the commencement, but I saw a good deal of it in the commencement.

20,444. Until what time?—I was on the Plague Committee from the 3rd March 1897 to the 7th May 1898.

20,445. Can you tell us what measures were adopted at the outset of the epidemic?—Only from hearsay. I was not associated with them.

20,446. What were the measures adopted during the time you were a member of the Plague Committee?—Segregation of the sick out of their dwelling-houses, removal of all persons from the room in which the patient was seized or had been lying sick, evacuation of the whole house if possible, destruction of the clothing, bedding, etc., which had been in use by the patient, thorough disinfection of the house, thorough cleansing and flushing of all privies and bathing places, and removal of all portions of the roof where such obstructed the sunlight and air entering the dwelling. The prevention of overcrowding was also considered of great importance. In the Second Committee, under Sir James Campbell, we modified those measures by establishing contact camps. The people who had been in absolute contact with the patients were segregated in a separate camp. These measures, I believe, are now adopted all over India; they were worked out originally by the Bombay Plague Committee.

20,447. They have been very successful?—Yes.

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20,448. What do you consider is the period of segregation?—I think, from the contact camp statistics, eight days at the outside. This seems a justifiable period from the figures. A comparison between the conditions of the people in camp and in their houses indicates the probably much greater infectiveness of the latter—confirms the opinion of the greater danger of plague-stricken human beings to others—illustrates how the epidemics spread—and helps to justify the measures adopted. I think the contact camp statistics are most reliable, because the contacts are persons who are most liable to infection, and they are the most likely people to give infection. I think that statistics from contact camps will cover all cases.

20,449. How do you account for the fact that plague stops when people are removed to segregation or contact camps or to hospitals as contrasted with the progress of plague when they are left in their own houses?—I think you have a barrier of fresh air between each person. The bacillus can only extend within a certain radius, and can only live under certain conditions such as darkness, dampness, and moist atmosphere. If you remove the people from the vicinity of such conditions you prevent them from becoming infected.

20,450. You have had a good deal of experience with regard to camps?—Yes.

20,451. You give the details of a considerable number in the supplement of the précis which you have handed in?—Yes. They are as follows:—

Camp.	Admissions.	Plague Cases.
Narel Wadi	16,385	40
Modikáhna	24,330	64
Wári Bandar	23,542	90
Byculla	14,400	—
Dádar	1,017	2
Byculla Bridge	400	8
Narel Wádi Health Camp	924	6
Kennedy Sea Face	964	5
Goculdas Tejpal	1,500	12
Elphinstone	1,500	—
Cruickshank	192	—
Elphinstone Bridge	783	3
Ellapa Ballaram	1,447	16
Mahratta	1,839	31
Total	88,723	277

These figures further confirm the opinion—(1) That a very small proportion of plague cases occur amongst people in camp, even when these are from the most heavily infected parts of the city, as evicts certainly are. (2) That a very large population was passed through camp in a very short space of time and on the basis of (1) this alone must have had a great and inestimable effect upon the epidemic. (3) That even in Bombay, with the greatest difficulties in the whole of India to contend with in such a scheme, the camp system can be carried out for a great part of the year with advantage. (4) That the camp system is the basis of all plague operations and that it is the only procedure which has an immediate benefit, for plague disappears amongst new arrivals into camp within a week, *i.e.*, if primary cases in camp are properly dealt with. (5) That the incidence of plague at one time falls with greatest severity upon sections of the population, and that these sections vary in the extent to which they suffer according to the degree of overcrowding and the nature of the houses. The method of combatting plague in a large city must be by attacking sections of the greatest plague incidence. (6) That the small proportion of plague cases amongst detentions indicates that where no detention exists, the influx of persons from an infected to a non-infected city brings only a small proportionate number of plague cases, but that, from these lying *perdu* in the the slums, an overwhelming epidemic will arise within two months unless prompt and severe means are taken. This, consequently, establishes the absolute necessity of strict detention, and, further, confirms the opinion of the great danger of infected human beings as carriers of plague.

20,452. You have had some experience with regard to inoculation?—Yes.

20,453. What are the data on which your views with regard to inoculation are founded?—My views are based on actual experience of 149 cases. When M. Haffkine first came to Bombay I saw a good deal of his work in the laboratory and I assisted him occasionally in doing his inoculations, and I have had conversations with him and have a general conviction as to the scientific value of his inoculation.

20,454. Will you give me the data?—One hundred and forty-nine cases were inoculated. There had been 12 deaths from plague among various households before inoculation. After inoculation there were four attacks of plague: two died and two recovered.

20,455. Did you observe these cases which you inoculated for some period of time?—I have the evidence for the whole year.

20,456. Are these figures borne out by the after-history?—Yes; I have enquired about them myself.

20,457. Have you seen any evil effects following inoculation? Do you adhere to your statement with regard to that?—Yes.

20,458. Will you put that statement in?—Yes. The possible evil effects are (*a*) Initiates disease by putrescence, only through careless manipulation, *e.g.*, cellulitis, septicæmia. (*b*) Initiates disease by entrance of the minute particles of débris into the circulation, which would give rise to endocarditis embolic. I have met with one case which gave rise to this suspicion. A Pársee girl, aged about 14, became ill after inoculation, and died two months later. I saw her a few days before death and found her suffering from endocarditis. I have discussed the case freely with M. Haffkine and asked him if the fluid could be filtered in view of this danger. The history of the case throws doubt on the contention that the endocarditis actually resulted from inoculation. She had suffered from fever before, the family have a rheumatic tendency, and I have recently seen a brother of her's, aged nine, who has an irritable heart attributed to over-exertion. M. Haffkine's reply to my question was as follows:—"The solid part in the plague prophylactic is a very "essential ingredient and cannot be filtered off. You "will see that at once when I say that the anticholera "vaccine contains only the solid part and that the "chief modification in the plague prophylactic was the "addition of the liquid portion. The above informa-"tion will also allay, I trust, the apprehension with "regard to the danger of those solid bodies. For if, "in the inoculation against plague, we did, by now, "tens of thousands of operations, P. being the only "patient about whom the question was raised,—in the "inoculation against cholera the number of operations "counts by hundreds of thousands, without my "having heard of the complication now in question." (*c*) Excites latent disease to active manifestation, *e.g.*, rheumatism, phthisis, neuritis, hepatic congestion, albuminuria. I have no authentic data of this. I have met with cases of rheumatism and neuritis which have occurred shortly after inoculation and were attributed to it, but I could not say that the inoculation caused the complaints. There was one remarkable case of a dhobi in Byculla, found during a house visitation and apparently very ill. He had acute pain in the side, and the search party thought he was a case of plague. He had fever. He had been inoculated a few days before. I found it to be simply a case of acute neuritis of the intercostal thoracic nerves. (*d*) Produces varying degrees of impaired health subsequently and for varying periods. Many persons have complained of this, but as a rule it does not last longer than ten days. My own máli was ill for months afterwards with gastric irritability and great depression. Most of the persons I inoculated were able to go about their work in three days without inconvenience.

20,459. You have made frequent observations at five intervals in many of these cases which you inoculated?—Yes. All my own servants were inoculated.

20,460. What symptoms did you observe to follow inoculation?—Pain and swelling of varying degree at the site of inoculation. A preceding period of depression, nausea and sometimes diarrhœa, with pains in the muscles and in the joint if the subject has a tendency to rheumatism. A stage of reaction when the temperature rises to 102° or 103°. In some cases the depression continues and a sub-normal temperature is registered with no pyrexia. The depression lasts for 12 or 24 hours or in some cases longer, and appears in about 12 or 16 hours after inoculation. There may be acute gastric and intestinal irritation. A stage of

subsidence, marked by a fall of temperature, free action of the skin and somewhat depressed state of health, may last for a day or two longer.

20,461. What is your view about the duration of the immunity?—I believe the duration of the immunity lasts a considerable time, and if fully carried out I do not see why it should not be for a life-time. As in the case of other infectious diseases complete immunity is not obtained but general comparative immunity. A person may contract plague after inoculation, but this is in a much redued probability, and if contracted, the disease is not so likely to be fatal. I have no authentic data, but I consider the statistics published by M. Haffkine fully reliable, and they support this view. I do not see why it should not be for a lifetime provided the person is thoroughly inoculated.

20,462. Why do you say that?—I think it is possible it might be.

20,463. One might equally say it is possible it might not be. Have you any facts to lead you to any conclusion as to the duration of the immunity produced by inoculation?—In one or two households which I inoculated the servants have been free from plague up to the present time.

20,464. To what length of time do you refer?—In my own household, during the last epidemic, the wife of one of the servants contracted the disease. She had never been inoculated. Her husband and his brother, who had been inoculated the previous year, were in constant attendance on the girl and never contracted the disease. They went to the Parel Hospital with her and were attendants on her there.

20,465. The immunity lasted one year, you think?—Yes.

20,466. Is it usual for persons who go to hospital and attend on sick persons to contract the plague?—No; but before they went to the hospital the girl had been suffering for two days. It was not reported to me, so that they were in close association with her for two days.

20,467. Are the hygienic conditions bad in your servants' quarters?—No.

20,468. I presume they are good?—Yes.

20,469. Is it usual for plague to extend in good hygienic circumstances?—It is not usual, of course.

20,470. I assume that that house is in a good hygienic condition with regard to ventilation and light?—Yes, very good.

20,471. Have you seen any cases in which after inoculation with an ordinary dose of the fluid the temperature of reaction appeared to be very slight?—I saw a good many of those when I was inoculating for Professor Haffkine in the Grant Medical College. A good number of the cases came and said they had no fever, but felt very depressed, and their temperature had been sub-normal. They were intelligent people and had taken their temperature, and in some cases it was 97—sub-normal. They said the skin had been moist, and they had felt a good deal depressed, but there had been no febrile reaction.

20,472. Have you any evidence that there was an immunity conferred upon those persons?—No, I cannot say that.

20,473. Did the same sample of fluid produce a marked tempetature reaction in other persons?—Yes.

20,474. (*Mr. Hewett.*) Have you found that in the quarters of Bombay which have good hygienic conditions the plague has not spread?—The Europeans and their native servants living on Malabar Hill lived under the very best hygienic surroundings, but yet the servants were attacked there and the epidemic spread all through the servants' houses, although very few Europeans were attacked.

20,475. Your servants were under the same conditions as the other servants on Malabar Hill?—I think so, practically.

20,476. Therefore, they were just as liable to attack?—Yes.

20,477. And the servants, generally, on Malabar Hill did not escape?—That is so; the disease spread from one end of Malabar Hill to the other.

20,478. Although the Europeans living in the same compound escaped?—Yes.

20,479. (*Dr. Ruffer.*) What do you mean by the abdominal type of the disease?—Evident symptoms of plague from the general clinical appearances, associated with great distension of the abdomen. *Major H. P. Dimmock, I.M.S.* 21 Feb. 1899.

20,480. What sign of plague was there in those patients? Had they buboes?—No.

20,481. How do you know they had plague?—From association with other plague cases.

20,482. Did you ever find the plague bacillus in any of those abdominal cases, or did you simply base your diagnosis of plague upon the fact that they were in contact with other cases?—I based my diagnosis principally on my familiarity with the general clinical aspects of the disease.

20,483. What were the clinical symptoms which led you to diagnose those cases as cases of plague?—The rapid onset of the disease, the high temperature, and the peculiar appearance of the patients, the congested eyes, and the facial aspect, the condition of the tongue and such like clinical symptoms. These were associated with very rapid development of abdominal distension.

20,484. Had they any buboes in the abdomen?—That I cannot say. We were not allowed to make a *post-mortem*.

20,485. Had they any intestinal catarrh or diarrhœa or anything of that sort?—No; there was no diarrhœa.

20,486. Did you examine the intestine after death?—No.

20,487. You made no bacteriological examination of any of those cases?—No.

20,488. You said that Sister Elizabeth had a pimple and got plague: where was that pimple?—It was near the groin.

20,489. How could she inoculate herself there? By scratching?—Yes; I think it was a mosquito bite, but I am not exactly sure. It was near the thigh.

20,490. What sort of pimple was it,—an acne pimple?—It was an insect bite, I think.

20,491. Were you able to trace any lymphangitis from that pimple to the next gland?—Yes.

20,492. Where was the next gland?—Above the groin.

20,493. The pimple was below the groin?—Yes.

20,494. Did she die?—Yes.

20,495. How long was the incubation period in her case?—I think four days.

20,496. You are not sure?—No.

20,497. Do you generally find the lymphatics leading from the point of inoculation to the next gland are enlarged? Supposing you get a bulla on the dorsum of the foot, do you find the lymphatics leading from that to the popliteal space or the groin are enlarged?—Yes.

20,498. Is that the rule?—It certainly was in the earlier cases I saw.

20,499. Are you in charge of any hospital now?—Yes, but not of any Plague Hospital.

20,500. In your précis you say "Tara Naikand's "Wadi in Dhobi Talao—house opened up; no disinfec- "tion, people suffered severely." Can you give us any details about that case?—I am afraid I cannot give you that.

20,501. You mean to say there was no disinfection, but the house was opened up and that people afterwards suffered severely from plague; is that it?—Yes. I remember the case, but I cannot give you the particulars. The house was opened up and there was no disinfection; I cannot remember exactly the reason why it was not done.

20,502. The people went back to their houses?—No; they were not moved out at all; the house was simply opened up waiting for disinfection, and then the disease still continued.

20,503. They were left in the house?—Yes.

20,504. (*The President.*) What does "opening up" mean?—The roof was taken off, the windows and partitions knocked down, and so on.

20,505. (*Dr. Ruffer.*) Can you state the conditions which influence the development of the bacillus outside the body, whether heat, moisture, and so on, will influence its vitality? How do you think the bacillus

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lives outside the body? What has it to live on?—In these little rooms, of course, the people spit on the floor, and they are very insanitary. Besides that, the floors are generally of cow-dung, which is rich in organic matter. The people themselves are, of course, also insanitary.

20,506. But how can it develop on the floor in saliva or in cow-dung? Supposing you take a tube of agar, which is a good nutritive substance, and plant the bacillus in one spot, does it spread from that spot? Does it not remain localised to that spot?—I suppose the bacillus must develop within the radius of a plague patient somehow or other.

20,507. What evidence have you to show that the bacillus develops or spreads from the excreta or in any other way?—One has not any actual evidence. I have never heard of anybody who had.

20,508. What excretions, do you think, are most infectious?—The saliva in pneumonic cases.

20,509. Do you think any other excretions are infectious?—I think the excretions of the mouth and nose are infectious. The excretions from the nose were most virulent in the case I have quoted. I am also inclined to think that fæces are infectious.

20,510. Why do you think so? Have you any facts bearing on it?—No, I have not.

20,511. When were the inoculations done at Malabar Hill?—In February 1897.

20,512. How long did you have those servants under observation afterwards?—My own have been with me all the time up to the present.

20,513. There were 149 of them; how long have you had the others who were not your own servants under your observations?—A good many of them are under observation. I always go and visit at the people's houses.

20,514. How many servants have you of your own who have been inoculated?—I think about 12.

29,515. How many of these 149 do you think you have seen since inoculation?—Eighty; that is, about one-half.

20,516. Have you seen any cases of *pestis minor*?—I am seeing them now.

20,517. We should very much like to see one; we have been trying to find them?—I saw them in the beginning of the epidemic of 1896 in the out-patient department of the Jamsetji Hospital.

20,518. What are their symptoms?—Principally mild fever, with slight enlargement of the glands, which passes away in three days.

20,519. Which glands are enlarged?—The cervical glands.

20,520. Why do you think they were cases of plague?—I thought *pestis minor* because I could not explain them in any other way. I have seen two or three cases lately.

20,521. (*The President.*) How long ago?—Within the last month.

20,522. Can you produce any?—I will do so if I can.

20,523. (*Dr. Ruffer.*) In one of the supplements to the précis of your evidence, you mention cases of re-occurrence of plague. Can you give us the facts relating to Dr. Daver's case?—I have not the facts.

20,524. Did you see the Customs clerk who was supposed to have suffered twice from plague?—No.

20,525. You mention a man who had the plague three times; Narayan Muljee: are you satisfied he did have it three times?—I am satisfied he had plague once. I do not see any reason to doubt that he had plague three times from the general description. I quoted them because I was convinced the history was sufficient.

20,526. You say there were two cases of recurrence of plague; what was the other?—They are quoted on page 151 of General Gatacre's report.*

20,527. Did that come under your own observation? They are reported to me.

20,528. Did you enquire into them yourself?—I saw one of them.

20,529. In the same supplement you mention the case of Mr. Lalla, who was inoculated twice and contracted plague and died. You also say:—"The "following evidence is in favour of the theory of "immunity; 15 All Saints Sisters, European and "Eurasian nurses, were employed on plague from the "J. J. Hospital, 11 were inoculated. None contracted "plague except one European nurse amongst the "inoculated. It was a mild attack and she recovered;" did you see these cases yourself?—They were under my continued observation the whole time.

20,530. Can you tell me how many of the non-inoculated got plague?—Only one; Miss MacDougal. She was infected through the mucous membrane of the eye and died. A pneumonic patient spat in her eye. That is a case of infection through the mucous membrane.

20,531. Then you have some evidence with regard to the Cama Hospital nurses?—Yes. Eight worked for several months on plague duty in the different hospitals. Of these there were four inoculated and four uninoculated. Amongst the inoculated there were no attacks of plague. Amongst the uninoculated there were two plague cases, one of which died and the other recovered.

20,532. (*Prof. Wright.*) You spoke of a series of coryza cases; had any of these patients buboes?—The glands of the neck subsequently enlarged. They had no buboes in the first instance.

20,533. Did any of these patients die?—Yes, several.

20,534. Did you succeed in tracing a connection between those coryza cases and other cases of plague?—No. They came from Thana, an outlying station.

20,535. You said that these cases were the starting point of an epidemic on Mazagaon?—Yes; that information was given to me by Dr. Weir.

20,536. You did not follow these cases up yourself?—No.

20,537. (*The President.*) In reference to the inoculations you performed, have you any facts as to the history of those who were not inoculated? Did they have much plague or no plague after the others had been inoculated?—I cannot tell you that.

20,538. There might have been none?—There might have been none, but I think there was plague among them. Plague was going on very severely all round.

20,539. With regard to the servants who had plague on Malabar Hill, how do you account for their having plague and for the friends living in the same compound, whether Europeans or natives, generally escaping the plague?—By the different conditions of housing.

20,540. Will you describe the difference?—The servants have small rooms, and if they are left to themselves they close the windows at night and shut the doors and live in a close, confined atmosphere.

20,541. You attribute the infection in their cases to the inefficient ventilation and light?—Yes.

20,542. I thought you told us that in the case of your own servants the hygienic conditions were good?—They were very much better than the general conditions of the ordinary natives.

20,543. Better than those you now refer to as the average conditions on Malabar Hill?—No; I think they are about the same all over Malabar Hill.

20,544. I thought you told us that the average conditions were bad. I suppose you admit that they are as bad as you have described them?—Yes.

20,545. But you previously told us that, in reference to your own servants, the conditions were good. How do you reconcile these two statements?—I mean that the conditions were good provided that the people themselves maintained those conditions.

20,546. Is it within your own knowledge that the servants in your compound did maintain good hygienic conditions in their houses in regard to air and light?—Yes, they did.

20,547. And they contrasted favourably with the general standard?—Yes.

(Witness withdrew.)

(Adjourned till to-morrow.)

* Report on the Bubonic Plague in Bombay" by Brigadier-General W. F. Gatacre, D.B., C.S.O., Chairman of the Plague Committee, 1896-7.

At The Secretariat, Bombay.

FIFTY-THIRD DAY.

Wednesday, 22nd February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

MR. J. P. HEWETT.
PROF A. E. WRIGHT, M.D.
MR. A. CUMINE.
DR. M. A. RUFFER.

MR. C. J. HALLIDAX, (*Secretary*).

Khan Bahadur N. H. CHOKSY called and examined.

Khan Bahadur N. H. Choksy.

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20,548. (*The President.*) What are your medical qualifications?—I am a Graduate of Medicine of the Bombay University.

20,549. Are you in the employment of Government?—No, I am in Municipal employment.

20,550. You have been in charge of Arthur Road Hospital ever since the plague began?—Yes.

20,551. (*Dr. Ruffer.*) How many cases of plague, altogether, have you seen?—Altogether nearly 4,000 cases have been under me; most of them have been seen by me personally.

20,552. You are of opinion that there are several types of plague?—Yes.

20,553. *Pestis minor, pestis ambulans, pestis bubonica, pestis septica, pestis pulmonaria* and non-typical forms of plague?—Yes.

20,554. Do you think these types merge into one another, or are they distinct?—I think they are quite distinct except in the case of the septic type where the simple bubonic form merges into the septic.

20,555. Do you think there is a special form of pneumonic plague?—Yes, there is.

20,556. Could you give us the symptoms of *pestis minor*?—The symptoms commence with a little febrile re-action lasting for a day or two accompanied by malaise, pain and tenderness and one gland may be enlarged. After a little rest in bed and ordinary treatment, or practically without any treatment, the patients recover.

20,557. How do you diagnose these cases from other bubonic enlargements?—Because they occurred at the time when the epidemic was amongst us, and they have not been observed in other periods.

20,558. Supposing you had no plague in the town, would you still be able to recognise this form of the disease?—From the experience we have now had, we should certainly look upon these cases with suspicion.

20,559. Suppose there had been no plague in the city of Bombay for two years, would you be able to diagnose a case of *pestis minor* without bacteriological examination?—I am afraid not.

20,560. What is the difference between such cases and *pestis ambulans*?—It is the difference of degree. In *pestis ambulans* you will generally find a patient with one or more enlarged buboes going on for a long time, and the buboes either remain as indolent swellings, or they sometimes suppurate after about two, three, or four weeks after the initial symptoms.

20,561. How do you diagnose a case of *pestis ambulans* from any other form of bubonic enlargement?—We exclude all other chances of error, such as venereal contamination or septic poisoning, or wounds or abrasions, and thus we arrive at the diagnosis by a process of exclusion.

20,562. I will put it to you in this way; there were soldiers, in the Shropshire Regiment for instance, with enlarged glands going on for five, six, or seven weeks, or even longer; how could you diagnose a case of *pestis ambulans* from one of these cases?—We take into consideration whether they have been in localities which have been infected, or whether they have come in contact with plague patients, or whether they have remained in areas which are infected, in which case they will certainly be looked upon as suffering from *pestis ambulans*.

20,563. The history of the case or the bacteriological examination are the only data on which to form a diagnosis?—I am afraid bacteriological examination would not be of very much use in these cases except, perhaps, in early stages—perhaps for the first day.

20,564. Then your means of diagnosis are limited?—We diagnose by the clinical features and the surrounding history of the patient.

20,565. Do cases of *pestis ambulans* have initial fever?—Yes, they have.

20,566. Have you ever made bacteriological examination of such cases?—No.

20,567. How do you know that they are cases of plague?—From the enlargement coming on suddenly with a little feverish reaction during the epidemic of plague, and when there is no other cause to account for it, no local injury or venereal taint.

20,568. What is the end of these cases? Does the bubo suppurate, or does it resolve without suppurating?—Sometimes they suppurate and at other times they remain like indolent swellings for a long period.

20,569. How long?—I should say sometimes for months together.

20,570. Without suppuration?—Yes.

20,571. What do you consider to be the simple bubonic form and the simple septic form of plague?—There is the difference of degree only with regard to the symptoms of the simple bubonic and the septic type. The symptoms which are described in the Report* all through apply generally to the ordinary bubonic plague. The septic form, of course, is more aggravated with extensive infiltrations and is more fatal.

20,572. In the pulmonary form of plague the lung symptoms are predominant?—Yes.

20,573. Then you have non-typical forms of plague in which you have slight fever, diffused swellings with more or less infiltration generally over the parotid and cervical glands, absence of glandular enlargements, and pain, and gradual glandular subsidence from the application of cold and the internal administration of calcium chloride. How would you diagnose such cases as plague?—Just in the same way as the first, *minor* and *ambulans pestis*; they occur during the time of the epidemic or during its wane.

20,574. Could you diagnose them unless there was plague about, or without a bacteriological examination?—The diagnosis, I must say, is inferential only: we have made no actual bacteriological examination of these cases.

20,575. Have you ever seen persons contract plague from such cases?—No.

20,576. How do you know for certain that these cases are plague?—They occur during the epidemic, they have a history of exposure to plague infection, they

* Report on Bubonic Plague, upon Observations of 939 Cases treated at the Arthur Road Hospital, Bombay, from 24th September 1896 to 28th February 1897, by K. B. N. H. Choksy

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have lived in plague-infected areas or houses and they also have fever.

20,577. Have you seen cases of mixed relapsing fever and plague in the same patient?—Yes.

20,578. Have you found in these cases the micro-organisms of relapsing fever and of plague?—Yes, in the same patient.

20,579. Both in the blood?—Yes.

20,580. Are these cases usually fatal?—No, they seem to run a more or less milder course, and there are more recoveries, when there is a mixture of these two diseases, than otherwise.

20,581. Have you ever seen cases of relapsing fever and diarrhœa?—Yes.

20,582. In your opinion are these the cases which have been described as abdominal plague?—I think so.

20,583. Why?—Because I must say I have not up to now seen a single case which could be called a typical case of abdominal plague, a case in which there are no external buboes, and no other symptoms except purely abdominal symptoms. I have not seen a single case of that typical form up to now.

20,584. Have you ever seen cases of cholera simulating plague?—No.

20,585. Have you ever seen cases of relapsing fever together with diarrhœa which looked like cholera?—Yes, very often relapsing fever patients have been sent to the hospital as cases of cholera, and on examination they have been found to be cases of relapsing fever and not of cholera at all.

20,586. What do you think is the ordinary mode of infection in plague?—The most frequent is infection from the skin.

20,587. What evidence have you to show that?—The evidence is, of course, seen in the preponderance of the buboes in the inguinal and femoral regions in those people who generally go about barefooted.

20,588. Have you examined the feet of all the patients who had inguinal buboes?—Yes, I have examined them very frequently with scarcely satisfactory results as regards the local re-action except in a few cases.

20,589. In how many cases do you think you have found local reaction?—Not more than five or seven per cent.

20,590. What do you mean by local re-action?—I mean something to show the point of entrance of the virus into the system—an abrasion or any channels of infection in the skin itself.

20,591. Would you consider an ordinary scratch a local lesion?—In this sense, that there is a channel for absorption from that.

20,592. Do not you find in a great many of these cases scratches round the outer malleolus? Do you not find scratches there from the irritation of mosquito bites and so on?—Yes we do.

20,593. Is it not possible that plague might enter through a scratch and leave no local lesion?—Yes.

20,594. I understand that many patients have cracks and fissures on the soles of their feet and elsewhere?—Yes.

20,595. Do you not think plague might come through them?—Yes, it might.

20,596. Without giving rise to any local inflammation?—Yes.

20,597. In a certain number of cases you have found small pimples on the dorsum of the foot?—Yes.

20,598. What did you find inside these pimples?—Bacteriological examination was made on two or three occasions and almost pure cultures of plague bacilli were taken out from them. We made an experiment in some cases by injecting pure carbolic acid into the pimples; the result was there was a sudden cessation of all inflammatory signs in the bubo; the fever subsided, and the patients seemed to show a rapid rate of recovery.

20,599. When you found a pimple on the dorsum of the foot, was the bubo already formed?—Yes, the bubo was already formed, and the history always was, that the pimple preceded the bubo by two or three days.

20,600. When you treated the pimple the bubo disappeared?—It gradually got smaller and all the symptoms abated.

20,601. Do you think the bubo is the sign that the plague-bacilli have invaded the gland already, or do you think that the bubo is due to the absorption of toxines?—That would be difficult to say, except by actual examination of the bubo itself.

20,602. Does not the fact that the antiseptic treatment of the pimple cuts short the disease, point to the possibility that the bacilli have not yet reached the gland?—I should think so.

20,603. You have no facts bearing upon that?—No.

20,604. Have you ever found blisters or primary sores at the point of inoculation?—Yes.

20,605. What are these blisters like?—They were blisters, either with a spherical cuticle over it, or with distinct umbilication on the top. In those cases the appearance was quite peculiar. It seems just as if a circle of glass had been put over the skin and a membrane tied over it, and the umbilication resembled something like that of magnified smallpox eruption.

20,606. Did you find plague bacilli in them?—Yes, I think they were found; I did not make any investigation personally.

20,607. Did you find pus?—No.

20,608. What was the fluid like?—It was serous fluid, more or less stained with blood.

20,609. How long do you find bacilli in the bubo?—Up to the period of suppuration and a little after.

20,610. I suppose at first there are a great many bacilli?—Yes.

20,611. Are they found not only in the bubo, but round the bubo also?—I have no experience of that.

20,612. You say the bacilli disappear when suppuration sets in?—After a time.

20,613. How long after?—Two or three days after the buboes have been incised we found the bacilli almost disappear.

20,614. How did you ascertain that—by cultivation?—By cultivation.

20,615. Do you find that other micro-organisms take their place?—Certainly. The ordinary microbes of pus must be there.

20,616. I want to know whether you found the pus microbes in the bubo before or only after suppuration?—I have not made any investigation previous to the incision of buboes.

20,617. In your opinion the sputum is infectious in cases of pneumonia?—Yes.

20,618. Is it infectious in any other cases as well?—I have seen a case only lately where there was nothing more than ordinary bronchitis, when the sputum was bronchitic, and still the plague bacilli were found in almost pure cultures.

20,619. Do you find it, in septicæmic cases, as a rule in the sputum?—Yes.

20,620. Do you find it in all cases in which you get secondary affection of the lungs?—If there is any infectious sputum it is found; but I have made no distinct investigation with regard to that.

20,621. Supposing a patient does not spit but has a slight cough, do you find the bacilli in his sputum then?—I have made no investigation with regard to that. I may be allowed to add that most of my practice has been clinical; I have had very little time, and have done very little bacteriological work myself.

20,622. Do you think the disease is contracted by inspiration?—Yes; it must come through inspiration in cases of pulmonary plague.

20,623. Why?—Because the lungs are the primary seat of infection, and we find the absence of plague-bacilli in the blood.

20,624. Supposing you get a cut on the foot and get a bubo in the groin, you find no bacilli between the foot and the groin; supposing on the other hand, instead of having a bubo in the groin, the secondary lesion was in the lungs, i.e., plague-pneumonia, would you find bacilli either in the blood or in any other organ?—I have made many examinations with regard to the blood, and have found that in some of the most typical cases of plague which have proved fatal there was a total absence of plague-bacilli in the blood from cultures.

20,625. How do you think the plague-bacillus is inspired into the lungs? I believe that you agree that it is not to be taken by the digestive canal?—Yes.

20,626. How does the bacillus get from the mouth into the lungs?—It must go with the inspired air. Besides, there is a certain amount of desiccation when the sputum is thrown about and gets dried up.

20,627. You think it is the dry sputum which is inspired with the air?—Yes.

20,628. Have you any evidence to show that the bacilli of plague will resist dryness?—I have no personal knowledge. There is this to be said, that the class of people from which we draw our patients are in the habit of spitting about anywhere and everywhere, in any part of the house. You will find that the sputum must lodge in the different parts of the room, and you will find it in various stages of dryness or moisture; it is quite likely that some of that may be absorbed, and produce the symptoms.

20,629. You have no evidence to show that plague-bacilli resist dryness?—I have made no experiments with regard to that.

20,630. Have you any evidence to show that either the fæces or urine are infectious?—No. Examinations were made, but we did not succeed in getting any plague cultures out of them.

20,631. You do not believe in the possibility of infection through the alimentary canal?—No.

20,632. Why not?—I have seen no evidence to support that view.

20,633. You have seen nothing like an abdominal case of plague?—That is so.

20,634. Have you ever seen primary lesions which you think were primary in the intestines of plague patients?—No.

20,635. Do you think that the vomited matter is infectious?—I do not think so.

20,636. Has not that a bearing upon the possibility of infection by grain?—I think it has indirectly; if the grain were the channel through which the plague germs entered, the primary symptoms would be in the intestinal tract or abdominal cavity.

20,637. Do you think the grain infectious?—No, I do not think it is infectious.

20,638. Some people say it is. For the sake of argument, we will assume the grain is infectious; how can it be infectious?—In the first place, most of the grain which is used is cooked; therefore, seeing that heat is destructive to the plague bacilli, there can be no infection, the bacilli would be destroyed.

20,639. Then the only way in which grain could be infectious is by handling it, the bacilli entering through cuts in the fingers?—In that case there would be no possibility of its entering directly into the alimentary canal.

20,640. Have you any evidence to show that flies, fleas, ants, bugs, and mosquitoes are infectious?—I have no evidence.

20,641. Have you ever noticed that the primary lesion in plague was just in places which would be likely to be bitten by fleas or bugs?—The exposed parts are always likely to be bitten by fleas, bugs, or ants.

20,642. How can the dorsum of the foot get infected from the earth? You say in your précis that, in a great many cases, the primary lesion was on the dorsum of the foot?—It may be through an existing abrasion. There have been cases in which infection has gone into the system through shoe-bites.

20,643. Would it be produced there by scratching, or flea bite or mosquito bite?—It is possible.

20,644. The natives sit a great deal with their hands on the earth?—Very often.

20,645. Do you think that fleas, ants, and bugs, might predispose to plague by producing local lesions which may be scratched?—The poorer classes of people are always full of scratches and lesions, without any bugs or fleas or any other extraneous agents.

20,646. What is the incubation period of plague in your opinion?—I think it varies from about three days to a fortnight.

20,647. Why do you think so?—In cases of mild form, like *pestis ambulans*, we have found from investigation that the period of incubation has been over the normal limit. We have put down ten days; it has gone up to a fortnight.

20,648. Could you give us a typical instance?—I can cite the case of a patient who came from Calcutta on a ship called the *Cleobaria*. The ship left Calcutta, touched at Colombo, and then came to Bombay. Thirteen days after the ship had left Calcutta, the man developed fever and bubo in the groin. He had no venereal taint and nothing to account for it, no injury. He was brought to Bombay and sent to the hospital. We made a close investigation of the case, and we found that the bubo had already softened, and in two days it suppurated. An incision was made, and we found that the contents were the ordinary slough found in cases of plague.

20,649. Did you find plague bacilli?—Unfortunately the investigation for plague bacilli was made too late—about 36 hours after the bubo had been incised and dressed with antiseptics.

20,650. Was there plague in Calcutta at the time?—It was not reported to be existing at Calcutta at the time. There was a great deal of controversy with regard to that particular case.

20,651. Where would he have got plague if there were no plague cases in Calcutta?—I am inclined to believe there were plague cases in Calcutta amongst the poorer classes.

20,652. What was the exact date?—It was the year before last. The patient was admitted into the Arthur Road Hospital on the 6th of October 1897.

20,653. Why do you think that case was plague? Was it simply from the appearance of the bubo?—Yes, and from the history of the case, the man having been in an infected locality in Calcutta.

20,654. But you have no evidence to show that Calcutta was infected?—They had cases of plague in Calcutta at the time. I do not know whether they were officially declared or not.

20,655. Do you think that the power of resistance or the general state of health of the patient may extend the incubation period?—Yes.

20,656. Have you any evidence to show that?—There is no direct evidence bearing upon the point, because it is impossible to fix the day upon which the poison could have been so absorbed.

20,657. It is simply an impression on your part?—Yes.

20,658. Have you any typical cases showing that the incubation period was over three days, or is it simply your impression?—There was a very typical case which I came across four months ago, the case of a Parsee lady. I was called to see her, and I found that she had ascending lymphangitis extending from the inner malleolus right up to the femoral region, with enlargement and pain of the inguinal and femoral glands. It seemed to me there was also an iliac (pelvic) bubo. I examined her very closely and I found nothing. When I came to the heel I found that there was a regular sore. I inquired as to when that sore appeared. She said that ten days before she had been to the Fort and had put on a new pair of shoes; the same day she developed that sore. Ten days after the development of that sore she had the bubonic symptoms. This indicates a period of incubation of ten days, the formation of the sore, and probably the inoculation of the poison, occurring at about the same time. She was living in a non-infected locality.

20,659. Did you find plague bacilli in that case?—It was not bacteriologically examined; it was treated with curative serum.

20,660. Did she recover?—She recovered. She had a bubo on the opposite side as well; she had a left pelvic bubo afterwards which developed in the course of the disease.

20,661. Did the buboes suppurate?—No, they resolved.

20,662. Do you generally find lymphangitis extending from the point of inoculation to the buboes?—Not always.

20,663. Do you find it frequently?—I have seen a great many cases.

20,664. Coming now to the clinical symptoms; can you give us any information as to the attitude of the patient?—I have described the attitude of the patient

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in my report*; the attitude is very greatly influenced by the condition of the patient as regards delirium or meningeal symptoms.

20,665. Is not the position of the bubo an important point with regard to the attitude of the patient?—Not particularly.

20,666. Does he not generally draw up his leg on the side of the bubo?—No; the general position is the extension of the legs, one leg crossed over the other; it is almost invariable. In children, drawing up of the leg on the affected side is more often noticed.

20,667. Does he not generally flex his legs—one crossed over the other?—Only when the infiltration is very great; otherwise, if the tension is not so very great, you will find the legs extended; that is what I say in my report,* that the attitude of patients depended upon the stage in which they were admitted. Generally, they were too far advanced to assume any characteristic position; but if recumbent they generally lay flat on the back, with the limbs extended and almost invariably one leg crossed over the other. This was so often observed and so persistent, that every time a thorough examination had to be made, the legs had to be separated apart. Otherwise, the position of the body depended upon the nervous condition of the patient. In the apathetic cases, the patient would generally lie on the one or the other side, with the arms and legs flexed, the former against the chest and the latter against the abdomen, in fact literally doubled up. If the patient could assume a sitting posture, the attitude indicated thorough prostration and helplessness, the head bent upon the chest, the arms and legs hanging listlessly.

20,668. Have you ever noticed anything peculiar about the gait of the patients?—They have a tottering gait.

20,669. Do you attribute that to the weakness of the limbs?—Yes; want of co-ordination.

20,670. But does not that peculiar staggering gait come on long before the patient is weak?—It comes on on the second or third day.

20,671. Does it not come on at once?—No, not at once, I may mention that I have had very few opportunities of seeing fresh cases; most of the hospital cases are in an advanced stage.

20,672. There is something characteristic about the aspect of the patients?—Yes.

20,673. Would you describe that?—The aspect of the patient was almost always characteristic, although it was considerably obscured during the height of delirium. Ordinarily, the plague seemed to be stamped upon the patient's features, giving it a characteristic, and not to be easily forgotten, appearance. The features depicted fear and anxiety, or sadness and resignation, as if from an intuition of the impending fate. In fact, what is called *facies pestica*, so characteristic of the affection, is typified in this mixture of dread anxiety and resignation.

20,674. I suppose the aspect of the patients afterwards varies with the condition of his lungs or his mental condition—whether he is delirous or not; there is nothing peculiar about it afterwards?—That is so.

20,675. Have you ever noticed anything special with regard to the speech of the patient?—The speech is always characteristic. It resembles that of a person under the influence of drink. At first the syllables are all spread out, the voice is thick and husky; sometimes it is very sharp, and the patient replies in a very angry tone.

20,676. Some patients are very irritable?—Yes.

20,677. Most of them are resigned?—Yes; of course then they are in a semi-comatose condition, having huskiness and thickness of speech.

20,678. Have you ever noticed aphasia going on during the course of plague?—Yes; it comes on very suddenly.

20,679. It is complete aphasia?—Yes.

20,680. The patient cannot articulate a single word?—No.

20,681. It is not only aphonia, but complete aphasia?—Yes; absolute aphasia; when the patient recovers he seems to speak like an infant first learning a word; although he is able to articulate, there is a complete loss of memory of words which sometimes lasts for a very long time, sometimes extending over a year or a year and a half before he completely recovers his speech.

20,682. He understands everything that is said to him?—Yes.

20,683. You say in your précis that there is a period of general malaise preceding the appearance of the bubo; is that usually the case?—No, not as a rule; of course it is impossible to get any information from these patients. Some of the more intelligent said that they felt out of sorts for some time.

20,684. Do not the bubo and the rise of temperature come on suddenly and very frequently without any warning?—Yes, rigor and rise of temperature, followed by the appearance of the bubo.

20,685. Have you seen any cases where there was no warning at all where the man has suddenly become very ill?—Yes; while at his work.

20,686. Does the temperature go up very suddenly, or slowly?—There is a difference as regards that in different cases; because we know that in some cases that have virulent infection, the temperature goes to the maximum within the first 24 hours, and rises up to 107 or 108.

20,687. How long does it take as a rule?—It takes three days to attain the maximum.

20,688. Does it go up more quickly in children than in adults?—Yes.

20,689. Do you think the rise in temperature in children is frequently greater than in adults?—Yes, frequently greater.

20,690. Is the temperature a criterion with regard to the gravity of the case?—No, the temperature alone is not a criterion as to the gravity of the case.

20,691. Do you mean to say that you have had very fatal cases with a high temperature?—And also with a low temperature.

20,692. Is the temperature a remittent one?—Yes, it is remittent.

20,693. When do you get remissions?—Practically, the remissions commence on the second or third day.

20,694. It goes down in the morning?—Yes, and rises in the evening. There is a difference of about a degree or a degree and a half between the morning and the evening variations.

20,695. What is the highest temperature you have ever observed?—110°.

20,696. When the patient gets well does the temperature fall down suddenly or gradually?—Generally gradually.

20,697. How long does it take to reach the minimum?—About four or five days.

20,698. And it reaches the normal about the tenth day?—Yes.

20,699. Did you ever get sudden falls of temperature?—Sometimes; they are generally associated with collapse and death.

20,700. Is that sudden fall of temperature sometimes preceded by a rise of temperature?—No, not generally.

20,701. When the bubo begins to suppurate do you get suppuration fever afterwards?—Generally when the temperature goes to about normal on the tenth day we find that the bubo has already suppurated.

20,702. When the bubo is opened do you get further fever?—Further fever goes on only if the slough is underneath the skin or if there is some deep-seated suppuration which we are not able to get at; otherwise the course is only the difference of a degree—between 98 and 99.

20,703. Have you ever taken the temperature after death?—No; but in some cases I have found hyperpyrexia in examining the bodies soon after death; I have examined the patients after death, and sometimes examined them when there was some doubt whether they were dead or not.

20,704. And you have found very high temperature?—Yes.

20,705. But you have never taken the temperature some hours after death?—No.

* Report on Bubonic Plague, by K. B. N. H. Choksy. Bombay, 1897.

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20,706. When does the bubo generally appear?—Generally after fever or coincident with it.

20,707.* How many hours after the rise of the fever?—Eight or ten hours at the utmost.

20,708. Do you find the appearance of the bubo is delayed sometimes?—Yes; it comes on sometimes as late as six or ten days after the initial fever.

20,709. Do you find that in mild cases or severe cases?—In some severe cases I have seen that—in cases that have terminated fatally.

20,710. Is the pain in the bubo severe?—It is very severe as a rule.

20,711. Is it severe when you leave the patient alone, or only severe when you touch it?—That severity depends upon the tension of the bubo and the infiltration round about it. Sometimes you find a very small bubo extremely tender. In other cases you can move about large masses without pain.

20,712. I am afraid I did not put my question clearly; suppose you leave a patient alone and do not touch the bubo, is there any pain in the bubo?—Yes.

20,713. What sort of pain?—Dull aching pain; of course, the patients are not able to describe it exactly, they say it is an acute pain.

20,714. When you touch it, is it tender?—Yes.

20,715. Do you find that the swelling extends to some distance around the gland?—The gland gradually gets larger and larger until it has attained a certain size; then there is cessation of further swelling.

20,716. Does an axillary bubo spread down the sides of the chest and arms?—Yes, with a few exceptions, and almost always accompanied with extensive infiltration.

20,717. And the buboes in the neck?—Yes, it is the same.

20,718. Does it sometimes extend to the larynx?—Yes, and presses upon the larynx; it presses on the œsophagus and prevents deglutition.

20,719. What is the exudation like, is it serous?—It is either serous or sero-sanguineous.

20,720. And contains a large number of plague bacilli?—Yes.

20,721. Are there hæmorrhagic symptoms?—Yes, especially in the neck.

20,722. What is the swelling like to the touch?—The bubo feels like a dense mass; the infiltration feels more or less doughy, softish; in fact, you might almost call it fluctuating.

20,723. Do you sometimes get erysipelas from the bubo?—Yes, especially in the cervical bubo.

20,724. Have you found the streptococcus of erysipelas in these cases?—I have not made any examination.

20,725. Do you think the rapidity of exudation is a prognostic sign?—Yes, a prognostic sign, and almost always meaning fatal results.

20,726. You mean when it spreads quickly?—Yes.

20,727. Do you think the size of the bubo is any prognostic sign?—None at all, except that in some cases where there are very small buboes, the cases have terminated fatally.

20,728. Will you put in a table giving the total number of femoral and other buboes, brought up to date and work out the percentages?—(Witness subsequently submitted a statement* showing the position of buboes and mortality in 2,723 cases. He explained that, on account of pressure of work, it was not possible to supply the figures for 4,000 cases.)

20,729. Does inflammation of the lymphatics spread from the point of inoculation to the bubo?—Yes.

20,730. Does it spread from the bubo to other buboes?—Yes.

20,731. You have seen that?—Yes.

20,732. I suppose the bubo may slough, may it not?—Yes.

20,733. What is the character of the slough?—The slough is very peculiar; there is generally a mixture of slough and pus; I mean you find the buboes softish, and when you make an incision all you find is that it contains a central cavity with a drop or two of pus; and the whole mass is sloughy; the slough is very hard and sometimes almost cheesy, at other times it looks like a thick tissue, something between cartilage and muscular tissue.

20,734. Does it separate easily?—No, it takes a long time; in only a few cases is it possible to take out the whole gland *en masse*.

20,735. Do granulations form easily, or is the healing slow?—The healing is not very rapid, although granulations seem to form soon.

20,736. I think you said in your report* that it sometimes takes a very long time to heal?—That depends upon the state of the infiltration. In ordinary suppuration with very little or no slough, you find the incision heals very quickly. When the pus and sloughs are extensive or buried between the sheaths of muscles they take a much longer time.

20,737. Do you find the pus has the tendency to extend between the muscles and in the muscular tissue?—Yes; sometimes it forms a regular abscess.

20,738. When the bubo is in the iliac or femoral regions?—Yes.

20,739. When the bubo is in the femoral region, does the pus burrow as far as the popliteal cavity?—Yes.

20,740. Of course, that takes a long time?—Yes; the patient dies from exhaustion by the suppuration.

20,741. Have you seen sloughing of the muscles of the abdominal wall?—Yes, but I think that is generally due to the caustics applied by the patients themselves, except in cases of local necrosis. There is a regular dissection of the abdominal wall.

20,742. Have you ever seen sloughing of the genital organs?—Yes; the whole scrotum sloughs, and the testes have been exposed; in females you will find the labia in an almost gangrenous condition.

20,743. What is the pus like?—Sometimes it looks a thick creamy healthy pus, as we find in ordinary abscesses; at other times it is thin and watery; sometimes it is stained with blood.

20,744. You say in your précis it is an acrid pus?—I mean the irritant pus.

20,745. You mean, it irritates the parts around it?—Yes.

20,746. Do you find that the blood vessels suffer in a bubo?—I think they are easily cut, and their walls become soft.

20,747. Have you ever had secondary hæmorrhages?—Yes, from ulceration.

20,748. How long did the hæmorrhage last?—We stopped it promptly by tampon, and by means of compression we were able to control it altogether.

20,749. Are you sure that it was the femoral vein?—I think so.

20,750. Hæmorrhage from the femoral vein is usually fatal, is it not?—This case did terminate fatally afterwards.

20,751. Not from hæmorrhage?—No; but it took much time to control the hæmorrhage.

20,752. Do you find the sinuses take long to heal?—Yes.

20,753. What is the cicatrix like?—It is generally puckered in cases with extensive infiltration, and it has sometimes a keloidal appearance.

20,754. With regard to the symptoms in the nervous system, what are the reflexes like?—They are dulled.

20,755. Have you tried the patellar reflex?—Yes we generally have the patellar as well as reflex of the ankle-clonus.

20,756. What is the character of the delirium?—It varies; it may be either a muttering delirium or a most violent and maniacal delirium with homicidal tendencies. The patients try to get out of bed, and run out of the hospital. They try to crawl beneath their beds; they go and fall upon a contiguous bed.

20,757. Is the delirium nocturnal or diurnal?—It is more nocturnal.

* *See* App. No. LXI. in this Volume.

* Report on Bubonic Plague, by K. B. N. H. Choksy. Bombay, 1897.

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20,758. Is it anxious delirium—do not they show any symptoms of fear?—Not when they are in delirium; it is impossible to say what their exact mental state is at the time.

20,759. Is it more marked in young than in old people?—I think in young and old—but, perhaps, more in infants and children.

20,760. How long does it last?—It lasts from about four to six days; of course there are patients that take a longer course.

20,761. Have you found in patients a tendency to get out of their own beds and crawl into somebody else's bed?—Yes, they do that very often, and we have to tie them down.

20,762. Do they try to assume a certain position?—Yes.

20,763. Do they try to escape?—Yes.

20,764. What is the state of the sphincters?—There is almost always retention of the urine; in fact, every other patient used to have a catheter used.

20,765. When does that come on?—Immediately after the second or third day.

20,766. Do you get involuntary evacuation of the urine in some cases?—Occasionally; except it may be, perhaps, in a patient who is in a comatose condition from over-distention of the bladder.

20,767. Have you ever noticed that patients have a tendency to assume a professional attitude, such as praying?—Yes, such as cart-driving and cab-driving; some were in a devout mood, falling on their knees with their hands clasped, as if in prayer.

20,768. Shoemakers will sit down as though they were making shoes?—Yes.

20,769. Some are extremely merry, are they not?—Yes.

20,770. They burst into peals of laughter?—Yes, and that is associated with tetanic symptoms; almost all those cases of loud laughter are cases in which the tetanic symptoms are developing, or are in full strength.

20,771. Do you mean they get tetanus?—Yes.

20,772. You have seen cases of tetanus occur?—Yes, tetanus with marked spasms and opisthotonos and arching of the neck as well as of the back.

20,773. In patients whose buboes are opened?—No, early cases, on the second or third day.

20,774. Are these cases of mixed infection of plague and tetanus?—It is impossible to say.

20,775. You have not made bacteriological examination of that?—No, the cases all proved fatal.

20,776. They were typical symptoms of tetanus?—Yes; in fact, sometimes the spasm was so strong that all the respiratory muscles were fixed like a board; the use of nitrate of amyl or nitro-glycerine averted death in some cases.

20,777. I think you said that they were all fatal?—I mean averted temporarily.

20,778. What is the sensibility—are they hyper-sensitive?—Sometimes they are hyper-sensitive, and wince before the finger touches the bubo.

20,779. They are afraid of being hurt?—Yes.

20,780. Did you find when you actually touched them that they felt the pain more than the ordinary patients?—The state of pain depended upon their delirious condition; sometimes they are roused out of deep coma by pressure.

20,781. Some are talkative, are they not?—Yes.

20,782. They talk the whole time?—Yes.

20,783. Have you seen instances of hallucination?—Yes.

20,784. Have you seen any hallucination of the sense of smell?—No.

20,785. Where the patient thinks he smells all sorts of things?—No, I have not noticed that.

20,786. Have you seen convulsions?—Yes, especially in children; of course there are something like epileptic convulsions, in some cases before death.

20,787. Have you found as an after-effect of plague a sort of apathetic condition lasting for some time?—Yes.

20,788. How long does it last?—I have seen it last three or four months.

20,789. What are its symptoms?—The patient lies in bed, doubled up, generally with his eyes half-closed; he is not cognisant of his surroundings or of his own personal state; he might pass urine and fæces in bed; he lives a sort of mechanical existence, everything which is forced down his throat he takes, and his mind is a perfect blank during the period.

20,790. He gets into a state of imbecility?—Yes.

20,791. Have you seen mania following plague?—Yes, but only in two cases. If the case takes an unfavourable turn, the patient gets feebler and feebler, is bundled up in bed, extremely peevish, whines or cries when disturbed; gradually it becomes extremely difficult to feed him or administer medicines, and he sinks into a marasmatic condition until death supervenes, the patient dying a complete physical and mental wreck. The condition of the patient in this stage is extremely pitiable, he becomes wasted to a mere skeleton and looks more like a corpse than a living being. The extremities are cold, pulse extremely feeble, eyes half or wholly closed, respiration shallow; there are sordes on the gums and teeth, the saliva lodges between the lips, and at each expiratory effort a little trickles down the angles of the mouth, mucus and bronchial secretion are visible at the orifices of the nose, and may be similarly discharged at each expiration. All the normal reflexes being dulled, the patient is speechless, and takes very little nourishment, or has to be supported on nutrient enemas. Even from this condition recovery is occasionally possible, and has occurred in about half-a dozen cases.

20,792. Have you ever seen hydrophobic symptoms in a patient?—No.

20,793. Have you ever seen deafness?—Yes, deafness is complained of.

20,794. Is that deafness due to some local condition of the ear, or is it central?—It is central.

20,795. Have you examined the ears of the patient?—Yes, very often.

20,796. You have not found local lesion?—No.

20,797. Have you ever found any hallucination of taste?—No.

20,798. Have you ever found permanent loss of speech after plague?—No, not permanent.

20,799. They have always recovered?—Yes.

20,800. Have you anything to say with regard to the circulatory system?—In no other acute infectious disease does the pulse—an index of circulation—present so many variations in force, frequency, volume and tone as in bubonic plague, and in no other disease is the disproportion in the normal ratio between the pulse, temperature, and respiration so divergent. The character of the pulse, apart from its frequency, varies with the course of the disease. The full and bounding pulse which is so often associated with high temperatures is conspicuous by its absence, and in the majority of cases the pulse is easily compressible, extremely feeble and very frequent. The feebleness of the circulation is well demonstrated by the feebleness of the pulse, so much so that in some cases with temperatures of 103, 104 or 105 the extremities may be not only cold, but almost icy-cold, and bathed in cold clammy perspiration. This was, indeed, very characteristic and was often noticed. Another index of the weakened heart's action was the pulse itself which could not be felt or counted at the wrist, and heart beats had to be counted instead. As the case advances, the pulse becomes intermittent, regularly or irregularly, more often the latter, and distinctly dicrotic. The dicrotism in some cases is extremely well marked, and in advanced cases may really be considered a reliable diagnostic sign. There is always a change for the better in this stage of circulation if the patient is going to recover, but, if otherwise, the state of the circulation becomes still graver, as shown yet by another variation in the condition of the pulse. It becomes of a beaded character—in fact, a regular water hammer pulse of aortic insufficiency—and it is not difficult to conceive what is thereby indicated. A step further and the inevitable must happen—failure of the heart's action. And this may be gradual or sudden. In a large number of cases the failure is gradual, the beaded pulse becomes quite imperceptible, the body temperature is scarcely

maintained, the circulation getting more and more feeble, and eventually collapse with fall of temperature and death result. In these cases much could be done to support the circulation and stimulate the heart's action, and it may even be possible in a few cases to avert failure and death. But no such hope can be entertained where the failure is so sudden—so surprisingly sudden,—as even to raise a doubt as to whether the patient is actually dead or not. A patient tries to sit up in bed, or gets out of it, or makes some sudden exertion, and falls down either on the bed or on the floor, and is found beyond all hope. Very often the heart fails suddenly without any exertion on the part of the patient. He may be sleeping quietly and dies suddenly. In sudden heart failure very often there are no indications of cardiac failure, the pulse may be of good volume, and tension, frequently easily compressible, but yet indicating no immediate danger.

20,801. Have you ever found murmurs in cases of plague?—Not distinct.

20,802. Have you ever found leucocytosis in the blood?—Yes.

20,803. What is your experience with regard to that?—In a number of cases examined by myself and Dr. Pöch, of the Austrian Mission, we found the number of leucocytes varying from 12,000 to 28,000. This was the largest number found in any case.

20,804. In fatal cases?—I cannot say that exactly.

20,805. You consider that the presence of bacilli in the blood is a grave prognostic sign?—Yes.

20,806. In how many cases have you found bacilli in the blood?—Generally, I found bacilli in cases which were very near death, or which had assumed a grave complexion.

20,807. Have you found bacilli disappear from the blood, and the patients recover?—Yes; but in a very few cases indeed.

20,808. In how many cases, do you think?—We had examined about 240 cases all told; but I do not think that in more than four or five cases was the thing observed.

20,809. Have you ever noticed epistaxis?—That is one complication; but it is not common unless the case is mixed with relapsing fever.

20,810. Have you ever seen cases in which the larynx is affected in plague?—Yes; the tonsils are affected first, and the larynx secondly.

20,811. Have you ever seen it secondly affected from the cervical glands?—Yes; and I think primary also, affecting the cervical gland, the poison passing from the tonsils and affecting the neck buboes.

20,812. We have been told that there was a form of primary laryngeal plague; have you noticed that?—I think the laryngeal plague is more a case of cervical buboes, with pressure upon the larynx from a mechanical cause.

20,813. Have you ever seen a pseudo-diphtheritic membrane on the tonsil?—Yes.

20,814. In cases where the bubo was in the neck?—Generally.

20,815. Do you, then, consider the tonsils are the point of entrance?—I believe so.

20,816. But it may be, possibly, brought in by food?—It may be from ordinary inspiration.

20,817. Or by food?—If the food is the channel, you ought to see some abdominal symptoms as well as infection of the tonsils.

20,818. Supposing the virus has been stopped at the tonsils?—That would show a selective action on the part of the tonsils to take up the whole virus, and not allow any to go into the stomach.

20,819. Supposing it went into the stomach, would it not be killed by the gastric juice?—You mean to say the secretion of the mouth would not interfere with it also?

20,820. You have no facts with regard to that?—No.

20,821. Is the hypostatic congestion of the lungs common?—Yes.

20,822. Did you find plague bacillus in the sputum in cases of hypostatic congestion of the lungs?—There is hardly any sputum in some of these cases.

20,823. Is the œdema of the lungs a common symptom?—Yes.

20,824. When does that supervene?—Generally, on the third day.

20,825. Do you think the œdema of the lungs is generally due to recumbent position, or to something more?—I think it is due to the recumbent position and flagging circulation.

20,826. You have already told us about primary pneumonia; did you get secondary pneumonia in plague?—Yes.

20,827. What organisms did you find then? Did you find the pneumo-coccus or bacillus of plague?—Both have been found in the same patient.

20,828. Is it lobular pneumonia?—Yes, in small isolated patches.

20,829. We have been told, in certain cases, that you get the whole of the lung, or a large part of it, involved; have you seen any such cases?—No; we have made several *post-mortems*.

20,830. It has always been lobular?—Yes.

20,831. What are the characteristics of the tongue?—The tongue is dry, and covered with a thick white fur in the centre; it is red at the tip and edges. The character of the tongue varies with the disease. In advanced, and neglected, cases it is of a brownish colour, and of regular rusty appearance; the lining chips off in flakes, leaving ulcers.

20,832. Have you ever seen a tongue of which the centre is perfectly clean and the two sides are furred?—I do not recollect such an instance. (Note by witness on correcting proof of his evidence—I have seen one case since the above evidence was recorded.)

20,833. You do not think it is a characteristic of plague?—No, it would not be common.

20,834. Have you ever seen acute glossitis in plague?—Yes.

20,835. What are the characteristics of that?—It is generally associated with cervical buboes and infiltration; the tongue is almost round over one-half and the other half is enormously swollen: the patient is unable to open his mouth, and has difficulty of respiration and deglutition.

20,836. Have you seen it in septicæmic plague?—I cannot say whether these cases are septicæmic.

20,837. Have you seen hæmorrhages from the tongue?—No primary or direct hæmorrhage except through ulceration.

20,838. Have you ever seen fissured tongues which bled?—Yes.

20,839. In septicæmic cases?—Yes, I think so.

20,840. What is the appetite like?—The appetite is almost nil in some cases; occasionally, in the acute stage, the patient asks for food or says he is hungry.

20,841. We have been told that the appetite is preserved in a good many cases; that is not your experience?—I do not think so, the patients take whatever is given to them by the nurses, and they have very little choice in the matter, they might like it or they might not like it, but they usually do not ask for food or say that they feel hungry.

20,842. Is thirst very great?—Yes.

20,843. Is it a marked symptom?—Yes, they always call for ice water.

20,844. Is the vomiting bilious?—Yes, generally; I think it is due partly to the calomel and soda which they get as treatment when they are admitted; but, apart from that, vomiting is at times very persistent and troublesome.

20,845. Lasting several days?—Yes.

20,846. Have you noticed any blood in the vomiting?—Occasionally.

20,847. Have you noticed hiccough?—Yes, it is very persistent either in acute or convalescent cases.

20,848. How long does it last?—It may last for a fortnight, practically defying all treatment.

20,849. Have you found that in septicæmic cases and bubonic cases only?—Yes.

20,850. What is the state of the bowels?—Generally costive; diarrhœa comes on just before the critical period, just before death, in some cases.

20,851. There is nothing special about the motions?—No, except a peculiar smell, which I found very characteristic and very offensive.

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20,852. Have you found that melæna is a common symptom?—It is observed in a certain number of cases.

20,853. Is that observed just before death?—No, as an ordinary complication.

20,854. Do you think a patient has frequent hæmorrhages in the bowels?—Yes, and in the stomach also in some cases. There is coffee-ground vomit, partly-digested blood, and sometimes almost pure blood, is brought up.

20,855. What are the characteristics of the urine?—It is always highly-coloured and albumen is present, the chlorides are diminished, and there are always hyaline casts.

20,856. Have you ever seen uræmic symptoms?—No.

20,857. Have you ever found bile pigment in the urine?—Yes.

20,858. Frequently?—Yes.

20,859. How do you test for it?—By nitric acid and sugar, I think.

20,860. In another report, I find that the free excretion of urea and uric acid and absence of albumen blood and renal casts in the urine are favourable signs, and the return to the normal quantity secreted and the presence of chlorides one of the first signs of amendment; is that your experience?—Yes, the chlorides do gradually commence to increase as the condition of the patient ameliorates.

20,861. Do you think that the catamenial discharge has any influence on plague in women?—It is brought on prematurely by plague.

20,862. Do you find it has a bad influence on the course of the disease?—It might have, indirectly, by causing too profuse hæmorrhage, and thereby further weakening the patient.

20,863. Is it your experience that it is so?—I think so.

20,864. I believe pregnant women usually abort and die?—Yes, recoveries are very rare.

20,865. There is an idea among people that syphilis protects against plague; have you ever seen a syphilitic patient with plague?—I have seen patients with fresh venereal infection and having all the symptoms of plague in them. I do not know about constitutional syphilis of long standing—I have had no experience of that.

20,866. But you have seen primary syphilis and plague in the same patient?—Yes.

20,867. Do you ever see plague in the fœtus?—No, I have not made any investigations with regard to that.

20,868. What have you to say with regard to cutaneous and cellulo-cutaneous symptoms?—The cutaneous manifestations of plague are many and various, and may be noted as:—(*a.*) Ordinary blebs or blisters. (*b.*) Blebs or blisters with hæmorrhage or acrid serous pus. (*c.*) Dark depressed blisters, ordinarily called black boils. (*d.*) Localised cutaneo-cellular necrosis. (*e.*) Gangrene. (*f.*) Abscesses.

(*a.*) Ordinary blebs or blisters.—These with serous contents were observed in a few cases at an early stage. The blister comes on generally without any appreciable cause or after, perhaps, slight friction, the limbs becoming somewhat hot. If punctured, the contents are perfectly serous like those of any ordinary blister, but the cuticle appears of a dark brownish colour. The surrounding skin may have a threatening darkish look and if not properly attended to, the limb may become gangrenous.

20,869. Are these primary lesions you speak of on the dorsum of the foot, for instance?—Not necessarily.

20,870. You say that the limbs become gangrenous; how far does the gangrene extend?—I have seen it extend almost to the half of the lower extremity.

20,871. Does the patient lose the limb?—Generally, a line of demarcation forms; I have not waited for that, I generally injected the sublimate at the periphery just where it was spreading; that has checked further spread of the gangrene.

20,872. Did you ever have to amputate?—No.

20,873. Will you proceed, please?—(*b.*) Blisters with hæmorrhagic acrid serous pus.—These were observed in some advanced cases, the blisters covering almost the whole body, but more especially the limbs, and running together into large shapeless bags. The contents were generally made up of unhealthy pus or a mixture of it with blood.

(*c.*) Dark depressed blisters.—The so-called "black boils" were observed in a large number of cases, and they seem to bear a distinct causative relation to the buboes in their neighbourhood. They differed from ordinary boils in that no inflammatory areola surrounded them. They consisted essentially of a blister, in which the cuticle had become raised sharply and evenly from the skin, without any redness or signs of inflammation. In fact, it appeared as if a glass circle had been fixed over the skin and its top tied with transparent tissue paper. The top was centrally depressed or umbilicated, and from this there descended to the bottom a central slough, reaching down to the skin. The space around the slough was filled with pus or sero-sanguineous fluid. When the cuticle was removed and the central core or slough separated from the base, there remained a punched-out unhealthy looking ulcer which was difficult to heal, and took a long time to granulate. If seen early, the cuticle of these blebs used to appear normal.

20,874. Did you ever see localised cellulo-cutaneous necrosis?—Frequently.

20,875. What does it look like?—In the advanced stage you will find a large dark greenish looking surface, surrounded by inflammatory areola, which is depressed in the centre, with a line of demarcation all round.

20,876. It looks like wash-leather?—Yes.

20,877. Can you check that in any way?—I have succeeded in checking it by injecting sublimate at the circumference.

20,878. Have you ever seen desquamation after plague?—No.

20,879. Have you seen any eruption of the skin?—Yes; like herpes and sometimes like eczema.

20,880. Where were the eruptions?—They were generally spread over a part of the body; and the herpes were generally confined to the face.

20,881. What part of the face?—Generally along the lips.

20,882. The same as you get in pneumonia?—Yes.

20,883. Is there such a thing as plague-rash?—I have seen in some cases, just before death, small petechiæ spread over the body, or sometimes in contiguity with exudation, but none can be said to be a characteristic sign of plague.

20,884. Have you ever seen gangrene of the limb after plague?—Yes.

20,885. How far did the gangrene extend?—In one case right up to the forearm.

20,886. From where?—I think from the thumb.

20,887. Did the man get a local lesion of the thumb?—I think there was a local lesion.

20,888. Did you have to amputate?—No, the gangrene was also stopped by sublimate. In both the cases in which it was very well marked the sublimate stopped it.

20,889. You had only seen two or three cases of that?—Yes.

20,890. Have you ever seen abscesses?—Yes; they form in all parts of the body.

20,891. Have you seen petechiæ form?—Yes, before death.

20,892. It is said that there is a peculiar smell in plague; have you noticed that?—Yes, I have noticed it very often; very marked, especially when the plague epidemic is at its height.

20,893. Do you think it is more the smell of the dirt of the patient?—No.

20,894. Do you think it is peculiar to the plague?—It is peculiar to the plague; I have often been attracted by the smell, and have asked the nurses to examine the bodies, which they have found to be thoroughly cleaned and disinfected. The smell sticks to the patient even after disinfection.

20,895. Captain Thompson describes it as an earthy, cellar-like smell?—I do not think I can describe it in any particular way.

20,896. Have you ever seen complications of the eyes?—Yes.

20,897. Can you tell us about them?—There is generally ulceration either of the cornea leading to

perforation or hypopyon, or a general destruction of the eyesight in a short time.

20,898. What is the cause of that? Is it due to infection of the eye from the bubo?—No; I do not think there can be any direct infection of that kind. There is hardly any time for it; it comes on in the acute stage.

20,899. Do you get conjunctivitis?—Yes.

20,900. Do you think it is due to inability to close the eyelids?—There is such an amount of injection at first when the patient gets plague that there is very little difference between it and acute inflammation; and inflammation comes on long before there can be any irritation from inability to close the eyelids.

20,901. Have you seen any photo-phobia?—Yes. In some cases there is lachrymation also.

20,902. Do you sometimes get arthritis coming on in plague?—Yes.

20,903. Is that in cases treated with serum?—Yes; and often in cases not treated with serum.

20,904. How long does the arthritis last?—It may last three or four weeks. There is no actual arthritis always; sometimes you will find arthritic pain without arthritis; the patient complains of pain.

20,905. Do you get effusion into the joints?—Yes, and swelling.

20,906. Do you ever get pus in the joints?—No.

20,907. In how many cases does it occur?—In about 4 or 5 per cent. of cases.

20,908. Can you tell what are the factors which would affect the prognosis?—There are very many different causes which lead to it.

20,909. Do you find that stout people suffer more than thin people, and so on?—Stout people die much sooner than thin people.

20,910. You think obesity has a distinct influence?—Yes, I have found some of the Bombay workmen—labourers in the docks—who have got very good physique—succumb to the infection in a short time, and die within 24 or 36 hours after infection.

20,911. Can you put in a table of mortality up to the present time, including all your experience, and giving particulars of race, sex, age, and occupation?—I have got two tables* here—one, beginning in September 1896, and ending in February 1899, showing the number of cases treated, and deaths within 24 hours, and deaths within 48 hours, the total mortality, the recoveries, and the percentage of mortality. The other tables required I will prepare and submit later.

20,912. Do you find that children die more easily from plague than adults?—During the first epidemic, I found that the incidence of mortality was very great among children; but, subsequently, they seemed to make more recoveries in proportion to the adults. They had convulsions and other intercurrent diseases, which also carried them off in large numbers.

20,913. Do you find that many or few children come into the hospital?—I think a good proportion are children.

20,914. Do you find a good proportion of children under five or six years old coming into the hospital?—Yes.

20,915. What does a patient usually die of?—I think failure of the heart's action is the primary cause.

20,916. Do you find œdema of the glottis?—In some cases.

20,917. Hæmorrhage also?—Yes.

20,918. Have you ever found nervous sequelæ in plague lasting for a long time?—Yes, such as paraplegia, peripheral neuritis, paralysis of the extensor muscles, and wrist-drop as in lead palsy.

20,919. Have you seen them in the feet, or chiefly in the hands?—Chiefly in the hands.

20,920. Have you ever seen spastic-paraplegia?—No.

20,921. Mental depression?—Yes.

20,922. Have you ever seen dysentery following plague?—It might be there, but nothing marked.

20,923. Have you ever seen relapses in plague?—Yes, I have seen they are very frequent, in fact, nearly 50 per cent. or 60 per cent. develop an iliac or pelvic bubo.

20,924. What becomes of the bubo?—It resolves generally, and if it suppurates it means long illness and probably death.

20,925. (*Prof. Wright.*) Do you get another rise in temperature?—Yes, and in fact the patient gets through a regular secondary, but milder, attack of plague.

20,926. (*Dr. Buffer.*) Have you ever seen a man who had plague twice?—No.

20,927. Do you think that plague brings out certain latent diseases?—Yes, especially malaria and phthisis.

20,928. Do you think it has a good effect on certain infectious diseases?—It might modify them in this way; as relapsing fever and plague modify each other, it is possible that other diseases might be favourably or unfavourably modified. I have seen small-pox and plague together in the same patient.

20,929. How long do you think a patient remains infectious after plague?—After the buboes have suppurated, I suppose all the infection disappears in about three or four days after the opening of the buboes.

20,930. Suppose the patient has lung symptoms as well?—Then it depends upon the duration of the lung symptoms.

20,931. Have you any experiments to show that the plague bacillus remains in the lungs of a plague patient for some length of time?—No.

20,932. The late Doctor Davda, who got plague in the hospital, had 10 c.c. of Doctor Yersin's serum injected as a preventitive about three weeks previous to his illness?—That is so.

20,933. And he had plague and died?—Yes.

20,934. Can you tell me anything about Dr. Galeotti's serum?—The first time that that serum was used in Bombay was in June 1897. We had only six cases in Bombay, and they gave very satisfactory results. That was the first experience, just when the first epidemic was declining.

20,935. How did you choose those six cases?—They were not selected; they were injected as they came in. At that time the admissions were few, and there was not much chance of making any selection.

20,936. Have you the details of these cases?—Yes.

20,937. Have you notes?—Yes.

20,938. Can you put them in, with the temperature curves?—Yes. (Witness subsequently stated that no detailed clinical notes of the cases treated were kept on account of pressure of work and want of proper assistance. The charts of all the patients were, however, available, with such remarks as were made on the same at the time of treatment and after death. These he forwarded together with a report on all cases treated with serum in the hospital.†)

20,939. Do you find that the injection of Dr. Galeotti's serum produces any marked effect on the temperature?—Yes, it does, if one or two injections have been made.

20,940. What happens?—The temperature falls by about three or four degrees, and there is a general improvement in the condition of the patient.

20,941. Improvement shown in what way?—As regards his mental condition and circulation and buboes.

20,942. Anything else?—The buboes cease enlarging, and some altogether disappear. Of course, we go on injecting the serum by greatly diminishing doses until the temperature comes to the normal and stops there.

20,943. Have you had any experience of it since those first six cases?—We had 257 cases done last year, which gave us 145 deaths and 112 recoveries, a percentage of about 56 mortality.

20,944. What is the normal mortality in your hospital?—The normal mortality is 71 per cent.

20,945. How did you choose these cases?—At first we took all cases. We found that there were about 30 moribund in the list of 257 treated; we found that the serum was simply wasted upon them, and, subsequently, we eliminated all the moribund and all the convalescents and semi-convalescents.

20,946. When do you begin to do that?—In April.

* *See* App. No. LXI. in this Volume.

† *See* Report by K. B. H. N. Choksy on cases in the Arthur Road Hospital, Bombay, treated with serum, with six charts of cases treated in June and July 1897, and 47 charts of cases treated in March 1899, printed in this Volume as Appendices Nos. LXII. and LXIII. In App. No. LXII. is also included a report on Lustig's serum by Captain L. F. Childe, I.M.S.

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20,947. After doing how many cases?—About 50 or 60 cases in the early days.

20,948. Then you eliminated all the moribund and convalescents and semi-convalescents?—Yes.

20,949. In spite of that, your mortality remains 56 per cent.?—Yes, the mortality of the moribund is included in the 56 per cent. Thirty cases are included; if they are eliminated, the percentage is about 49 or 50.

20,950. Did you eliminate all the cases that had been ill for some time, or did you choose your cases in any way?—We did not select them; we took them as they came in.

20,951. Did you inoculate every case that came in, or every other that came in; did you get controls?—With regard to controls, there is a great deal of difficulty. There is great difficulty in getting proper controls.

20,952. Will you continue your explanation with regard to controls?—I find there is a great deal of difference with regard to the races from which the patients are selected, one race having a higher mortality than another; then, again, the position of the buboes has a great deal of influence with regard to the mortality, axillary buboes, for instance, giving a mortality of 82 per cent., whilst the inguinal buboes have a mortality of only 66 per cent. Controls, in order that they may be proper for comparison, must be more or less similar as regards age, sex, race, duration of disease, position of buboes, general condition, and the state of the circulation. If they do not answer to these requirements, any conclusions arrived at must be fallacious. And it is not always possible to get such controls. The following tables bring together the statistics I have compiled of cases in 1898 treated with the serum and those not so treated:—

TABLE showing the NUMBER of CASES treated with Prof. LUSTIG'S SERUM during 1898, and comparing the MORTALITY between SERUM and NON-SERUM CASES.

1898. Months.	No. of Cases treated with Serum.	Died.	Recovered.	Percentage of Mortality.	Percentage of Mortality in Non-serum Cases.
March - -	35	23	12	65·71	75·89
April - -	95	59	36	62·11	69·37
May - -	43	20	23	46·51	73·68
June - -	—	—	—	—	57·14
July - -	9	3	6	33·33	90·90
August -	13	6	7	46·15	83·33
September -	38	20	18	52·63	96·72
October - -	24	14	10	58·33	95·12
Total -	257	145	112	56·12	79·12

—	No.	Died.	Recovered.	Percentage of Mortality.
Non-serum cases during the same period.	752	595	157	79 12

The above 257 cases include over 30 moribund cases. Subsequently all moribund cases were excluded, and so also all semi-convalescent and convalescent cases. The cases thus treated represented the average type of ordinary acute cases. In the deaths from serum-treated cases have been included several cases that had died during convalescence, at periods varying from four to ten weeks after the injection of the serum. In fact, they had died from intercurrent diseases, and not strictly from plague.

20,953. Have you excluded from these tables all the pneumonic cases?—We had no primary pneumonic cases.

20,954. What are the other good effects you noticed from Dr. Galeotti's serum?—The convalescence was rapid and there was less suppuration of the buboes.

20,955. Had it any influence on the cough of the patient?—Not that I noticed particularly.

20,956. Did you make any observations of micro-organisms in the blood?—They were made in my presence by Dr. Galeotti in two or three cases only; and it was found that the micro-organisms disappeared after the injection of the serum. Cultivations were made.

20,957. Did you notice anything else?—No.

20,958. I believe you had some experience with regard to Prof. Haffkine's serum?—Yes.

20,959. How many cases?—That was in December 1896 and January 1897. There was a mortality of 40 per cent.; 14 of those were acute cases, of whom six died and eight recovered, giving a mortality rate of 42·85 per cent. The number, however, was very limited. Then we had another trial with Prof. Haffkine's serum, side by side with Prof. Lustig's serum. There was no difference in the mortality between the serum cases and the non-serum cases.

20,960. Was there any difference in the mortality between Prof. Haffkine's series and Prof. Lustig's series?—Yes, in favour of Prof. Lustig's series.

20,961. You say that Prof. Haffkine's inoculation gave a percentage of mortality of 42·85, whereas Prof. Lustig's gave 56 per cent.?—49 per cent., excluding the moribund.

20,962. How long did you try Prof. Galeotti's serum?—It was tried from March to October.

20,963. What was the mortality in the preceding year from March to October?—Our epidemic of 1897-98 became practically over in June 1898. Then we had a rather severe recrudescence in July, August, September, and October.

20,964. Can you give us the mortality in the same months in the preceding year when no serum was tried?—The mortality during the epidemic:—

In March	1897	was	67	per cent.
In ,,	1898	,,	75	,,
In April	1897	,,	56	,,
In ,,	1898	,,	58	,,
In May	1897	,,	40	,,
In ,,	1898	,,	54	,,
In June	1897	,,	22	,,
In ,,	1898	,,	57	,,
In July	1897	,,	53	,,
In ,,	1898	,,	78	,,
In August	1897	,,	63	,,
In ,,	1898	,,	76	,,
In Sept.	1897	,,	66	,,
In ,,	1898	,,	82	,,
In October	1897	,,	51	,,
In ,,	1898	,,	84	,,

20,965. It was in 1898 that the serum was tried, was it not?—Yes.

20,966. In 1897 the average mortality was lower than 56 per cent., when there was no serum tried?—In 1897 we had no recrudescence during these months.

20,967. In 1897 the mortality was 67, 56, 40, 22, 53, 63, 66, 51 per cent., and in 1898 it was 75, 58, 54, 57, 78, 76, 82, 84 per cent.?—That is so.

20,968. Therefore the percentage was considerably higher when the serum was used than when it was not used?—The percentage was higher, not because serum was used, but because of the fact that from June to October 1897 there was no epidemic of plague; there were sporadic cases only: whereas in 1898 we had another severe epidemic during those months.

20,969. But, comparing the two, the proportion is not in favour of the serum?—The comparison would be fallacious, as the conditions were not identical. If we compare the mortality of serum cases and non-serum cases, there is a difference of nearly 23 per cent. in the same period. From March to October 1898 we treated 257 cases with serum, and 752 without serum. The mortality in the serum cases was 56 per cent., and amongst the non-serum cases 79 per cent.

20,970. Do you exclude moribund cases among the uninoculated people?—If we exclude the moribund among the uninoculated the percentage would stand at about 69. It has to be remembered that, among the uninoculated are included convalescent and semi-convalescent cases, otherwise the mortality rate in them would be higher.

20,971. That is only a difference of 9 or 10 per cent.?—Nearly 13 to 14 per cent.

20,972. What have you to say with regard to the *post mortem* appearances? — If it were possible to convey in one word the principal *post-mortem* signs of the changes that are found in the system, that would be hæmorrhage. Hæmorrhages in every conceivable and inconceivable part of the body, hæmorrhages in the dura-mater, in the larynx, in the mediastina, in the epi- and peri-pleura, in the epi- peri- and endocardium, and in the myo-cardium, in the lungs, in the stomach, in the intestines, kidneys, liver and spleen, in the bladder, in the intima of the vena cava and jugular veins, hæmorrhages in and around the buboes and in the subcutaneous cellular tissue of the neck, chest, arm, forearm, thigh, and legs, and even in the retro-peritoneal connective tissue. These hæmorrhages in one form or another were observed in all the 54 autopsies that were made, varying in extent in the organs affected, according to the nature of the case. It may be as well, however, to give a brief summary of the *post-mortem* appearances observed in the various parts of the body.

Brain and Membranes.—The meninges were injected, but hardly any traces of acute inflammation were found, except in one case. Hæmatoma of dura-mater was once observed; excess of fluid in the arachnoid cavity was well marked in a few cases, the ventricles being full, and the choroid plexuses œdematous and swollen. The brain substance showed the gross lesions, but it appeared softer than usual, the convolutions being swollen and œdematous. In fact, stasis had produced changes in the brain similar to those in the lungs, namely, œdema, but in a less degree on account of its peculiar circulation. No hæmorrhage was found in the brain substance.

Spinal Cord.—The spinal cord with its coverings was examined in a few cases, but beyond congestion nothing else was noticable.

Pharynx.—The pharynx was generally found congested, especially so in several cases with infiltrations. A pseudo-diphtheritic membrane of a dirty greyish brown colour was seen in a few cases covering it, as well as the tonsils, and extending towards the larynx. The tonsils showed occasionally abscesses within their substance, with acute inflammation and some hæmorrhage.

Larynx.—The larynx was injected and inflamed, and in some cases hæmorrhage was noticed beneath its lining membrane. The structures surrounding it, as well as the soft parts that line it, were œdematous, and the aryteno-epiglottidean fold was often found to be greatly swollen and œdematous, blocking the entrance and exit of air. The pseudo-diphtheritic membrane, above referred to, was noticed in two or three cases to extend to the larynx with deep cervical buboes and infiltration. The laryngeal symptoms were, as a rule, well marked. The thyroid was generally found to be normal. The trachea showed nothing beyond injection.

Lungs and Pleura.—The lungs were practically "blood-full" and in most cases, when there was not much extensive pneumonia, greatly œdematous. On section, a large amount of sero-sanguincous fluid flowed out of them, in fact they seemed to be thoroughly soaked in it like a sponge. The mucus in the bronchioles was frothy and blood-tinged. If pneumonia existed, it was of the characteristic lobular type, in isolated patches, having a mottled grey appearance, generally well raised above the surrounding lung surface, and surrounded by a ring of conjested lung, gradually merging into healthy lung tissue. Hæmorrhagic infarcts, abscesses, and occasionally a stray tubercle was noticed in some cases. Pleurisy was sometimes met with, and was of a fibrin[illegible] character. Hæmorrhages more or less extensive were noticed on the parietal, visceral, and diaphragmatic pleura, the latter being the less frequent, and of the two former, parietal pleura being the most often noticed with large hæmorrhagic patches. Hæmorrhages were also observed in the connective tissue of the anterior and posterior mediastina. The bronchial glands were observed in a few cases to show the characteristic tumefaction and swelling of plague.

Heart.—Pericardial fluid was found in some cases to be larger in quantity than normal. Hæmorrhages were found on the pericardium, epicardium, and also endocardium. They were also met with in the substance of myocardium, which was generally soft and in a state of acute degeneration, occasionally fatty. In some cases it was so soft that it could be rendered pulpy between the finger and thumb. The cavities were generally dilated, the aorta normal, and occasionally fresh vegetations and hæmorrhages were observed on the valves.

Œsophagus.—It was generally normal but in such cases as had extensive hæmorrhage in the gastro-intestinal mucous membrane, it also shared in the same, and showed occasional hæmorrhages.

Stomach.—The stomach was hardly ever found to be in a normal state, its mucous membrane was generally bile-stained and showed hæmorrhages which were extremely characteristic, inasmuch as they were always punctate, the same character being also noticeable throughout the intestinal tract. In the absence of hæmorrhages there was occasionally intense injection and fresh erosion of the mucous membrane.

Liver.—The liver appeared generally slightly swollen "blood-full," and in a state of acute infective degeneration, occasionally fatty. Its substance was soft and friable, and the capsule at times adherent. In one case only emboli of plague bacilli were noticed. The gall bladder was almost always full, containing thick, viscid, dark-greenish bile.

Spleen.—The spleen showed an acute tumor or enlargement, but not large enough to become prominent. It was generally in a state of acute degeneration, the capsule was adherent, and its substance soft, pulpy, and, in some cases almost diffluent, the spleen appearing like a bag containing a homogeneous jelly. Hæmorrhagic infarcts were noticeable on its surface beneath the capsule, and occasionally small abscesses and cysts were present. On section, the colour was of a deep chocolate brown, sometimes almost hæmorrhagic, the Malpighian bodies were swollen, and could, occasionally be distinctly seen, and so also the trabeculæ and the fibrous structure. In cases that had suffered from malaria, the peculiar dark pigmentation due to it was also noticed.

Kidneys.—The kidneys were in a state of acute parenchymatous degeneration, the capsule adherent, and stellate, and other hæmorrhages and hæmorrhagic infarcts were noticed in its substance. The cortex was thin, and the pyramids swollen, and so also were the Malpighian capsules which were at times traceable; small cysts and abscesses were also noticed in its substance. The suprarenal capsule appeared to be normal.

Mesentery.—The mesentery also showed hæmorrhages, and they were, besides, noticed in the retro-peritoneal connective tissue and in the loose connective tissue in the abdomen, surrounding the various organs. In some cases hæmorrhages were noticed on the inner aspect of the abdominal wall and also between the recti muscles. The mesenteric glands were not often seen to be much enlarged or infected. Whenever there was plague infection, they showed slight tumefaction and swelling, and could be at once made out from their dark purplish colour and from the hæmorrhages surrounding them. Hæmorrhages were also noticed in the ovaries as well as around the iliac glands Whenever the glands along the course of the vena cava showed infection, hæmorrhages were noticed in the connective tissue and around them as well as in the intima of the vein extending several inches both ways. The same was also noticeable in the case of jugular and femoral veins.

Intestines.—The intestines, small and large, showed punctate hæmorrhages, and in one case these hæmorrhages extended from the œsophagus to the rectum. The mucous membrane was generally found slightly inflamed, and sometimes slight ulceration was noticed.

Buboes.—The appearance presented by the buboes was quite characteristic, and their section, whenever infected, always showed characteristic appearances such as are not met with in any other affection. They were swollen, enlarged and surrounded by sero-sanguineous or hæmorrhagic exudation. On section, they appeared of a dark-purplish colour and "blood-full," and the appearance, as stated above, was always characteristic. The exudations around the glands have been already described, and so also the cutaneous manifestations found during life. Whenever the parotid was enlarged it appeared like a large lobulated mass, varying in size from four to six inches, and on section all the small component lobuli stood out distinct.

Bones and joints.—The marrow of long bones like the femur was often noticed in a state of acute red degeneration, as in other infective diseases, and the synovial fringes in the knee-joint distinctly infected.

Khan Bahadur N. H. Choksy.

22 Feb. 1899.

The *post mortem* appearances above described are from 54 autopsies that were made in my hospital, 47 by the members of the Austrian Plague Commission, and the rest by the hospital staff. The thoroughness, the extreme care and the intelligence which characterised these *post mortems*, each of them being a complete demonstration, reflect great credit on Dr. Heinrich Albrecht, the head of the Commission, and his assistant, Dr. A. Ghon, who conducted them, and I must own my deep sense of obligation to them for the way in which they utilized the material I had provided, and which forms the basis of these notes, and whatever credit attaches to them belongs to Dr. H. Albrecht.

20,973. How many of the attendants suffered from plague?—Very few; altogether, I think, there were only six of them; all those who contracted the disease were living outside in infected houses and not on the premises, and it is impossible to say whether they had infection from the hospital or from outside.

20,974. Did not one of the doctors get plague?—Yes, that doctor was working in the hospital and his house was not situated in a very sanitary locality.

20,975. Do you disinfect floors in your hospital?—We have patent stone flooring now and we wash it with disinfectants frequently.

20,976. Do you disinfect the clothes of patients?—Yes.

20,977. How do you disinfect them?—They are dipped in sublimate, carbolic acid, or phenyle.

20,978. For how long?—For five or six hours in a solution of 1 in 1,000 of sublimate, and in 5 per cent. solution in the others. They are steamed according to the native fashion, and washed.

20,979. What is the temperature you get in your steaming apparatus?—It is over 200° Fahr., and the steaming is continued at this temperature for over an hour. The steam penetrates through all the clothing, &c.

20,980. Will you describe the steaming apparatus?—It consists of fire, with a shallow copper basin containing water, and there is a sort of plinth round about the vessel, which is fixed, and wet clothes are piled on the top to the height of two or three feet, and the whole is tied up with a big thick blanket so as to make it as airtight as possible. The fire is ignited underneath, and the steam passes through the wet clothes.

20,981. How far do you think the steam penetrates?—I do not think it penetrates very far. It is the native system which they have been using for ages past, and they have made no improvement in it.

20,982. Did you notice plague in inoculated people during that time?—I had only a few cases, and in them the disease seemed to take a very favourable turn.

20,983. How many cases did you see?—About 12, with one death.

20,984. Had these people certificates of inoculation?—They had; they generally came from institutions where all these records are kept. Some came from Sir David Sassoon's Reformatory, and some from other schools. In every case particulars were supplied with regard to previous inoculation.

20,985. Can you put in a table showing how long after the inoculation they got plague?—(The witness subsequently wrote as follows:—I regret that I am not able to furnish a table as desired, as it has not been possible to sort out all the charts. No case, however, was inoculated within six months of getting plague; in all cases the inoculation had been performed from 7 to 12 months before).

20,986. Have you had any experience of inoculation yourself?—No; I have done no inoculations.

20,987. I believe you admit the friends of patients to the hospital?—Yes

20,988. How many friends come in generally?—If the friends wish to attend on the patients we allow two, one for the night and one for the day. Visitors are allowed at all hours except during the visits of medical officers.

20,989. Do the friends of the patients get plague?—There was only case. The husband of a woman who was attending upon her got plague while in attendance on her. But that is the only case.

20,990. How long do the attendants stay in hospital?—Throughout the convalescence.

20,991. And they do not get plague?—No.

20,992. (*Mr. Cumine.*) Are the attendants allowed to sit and sleep on the floor?—They sit on the floor, and sometimes sleep there too.

20,993. (*Dr. Ruffer.*) You disinfect the floor, I understand?—Yes; formerly we had earthen floors, and new flooring has been put down lately.

20,994. (*The President.*) Had you had any cases among the attendants?—Only the one I have just mentioned.

20,995. (*Mr. Cumine.*) You used to pour down disinfectants pretty frequently?—Yes; phenyle or some powder; still, there was a lot of plague-infected material going into the ground and sinking into the floor.

20,996. Before the floor of the hospital was paved it was plain mud, was it not?—Ordinary earth.

20,997. Was there any cowdung upon it?—During the plague epidemic we had hardly time to cowdung the floor; it was cowdunged during the interval; but during the actual plague visitation it was not done, because that would have necessitated the patients being turned out, and that we could not do.

20,998. I wish to know whether the difference between the mud floor in your hospital and the mud floor in an ordinary native house is that the latter is cowdunged and yours is not cowdunged?—That is so, and also we use disinfectants in the hospital, which is not done in the case of ordinary houses.

20,999. (*Prof. Wright.*) Have you had any opportunity of testing Simond's theory, that plague is communicated by the bites of insects; have insects ever been very common in your hospital?—They are very plentiful, especially flies and mosquitoes, at this season.

21,000. Are the nurses and medical attendants bitten by fleas and bugs?—Certainly by fleas and mosquitoes.

21,001. Do you think that occurs to any great extent?—To a very great extent indeed.

21,002. You do not attach much importance to Simond's theory in view of that fact?—I do not.

21,003. You do not think that insects are very likely to carry infection?—The conditions are different in the hospital from those in the closed rooms of the houses; but so far as the hospital is concerned, the evidence points the other way.

21,004. How do you think the fleas in the hospital differ from those in private houses? Are fleas not continually passing from the patients to the medical officers?—The patients are more cleanly and we get rid of all their clothing, and I suppose most of the fleas and bugs would go too. But certainly the mosquitoes are there in very large numbers.

21,005. Have you formed an opinion that plague is less common in children than in adults?—No.

21,006. Have you seen any cases of coryza associated with plague?—No, nothing very marked. (Note added by witness on correcting proof of his evidence:—Some have been noticed since this evidence was recorded.)

21,007. Have you had any epidemic of pneumonia in the hospital; pneumonic cases which have infected other people there?—No.

21,008. Have you any rats in your hospital?—There are plenty of rats in the compound.

21,009. Have you noticed that these rats become infected with plague?—I have never seen a dead rat in the compound.

21,010. You have seen numbers of living rats?—Yes.

21,011. Do you know whether this is the experience in other hospitals?—I do not know that.

21,012. Do you think these hallucinations which you have described are all hallucinations of sight?—Of sight and sound, both.

21,013. Have you noticed that they are associated with a particular kind of headache?—Headache is always complained of, but nothing very marked to associate it with one form of hallucination or other.

21,014. Have you noticed that œdema occurs on the front chest immediately before death?—We find in axillary bubo there is sudden exudation, and the patient dies.

21,015. Have you seen any œdema in the chest when there was no axillary bubo?—No.

21,016. Have you ever seen what are called choleraic cases of plague?—No.

21,017. Do you think plague patients are made much worse when they are moved to the hospital during the course of their attack?—*It* all depends upon the state in which they are. I would not advocate the removal of a moribund patient, or one who is likely to die in a few hours; it would be of no use to the patient. I should say that the earlier the patient is brought to the hospital, the better chance he has of recovery.

21,018. You have not seen that treatment, independent of serum treatment, has any effect on the course of plague?—The only treatment which seems to have any effect is to keep up the state of circulation. Patients have been kept up for two, three, or four days simply by hypodermic injections of strychnine, strophanthus, and digitalis, where otherwise life would have ebbed away in a few hours.

21,019. (*The President.*) Did they ultimately recover?—No, most of them ultimately died; it is simply a question of doing all you can for the patient.

21,020. (*Prof. Wright.*) You have said that blisters occur in the course of the plague; do they occur in several regions of the body at once?—I have seen only two or three cases in which there were multiple blisters all over the body; they are generally single.

21,021. Those are secondary blisters; they are not associated with the source of infection?—The multiple blisters are secondary.

21,022. What about the single ones?—I think they are primary.

21,023. (*The President.*) With regard to these modified cases of plague, *pestis ambulans*, and *pestis minor*, do you know if they are infectious?—I do not think they are.

21,024. Have you any evidence one way or the other?—I have seen a number of cases—not in the hospital, but outside—in private practice, where they have occurred; and there have been no further cases in the same families.

21,025. Have you generally found pneumo-coccus in pneumonic cases?—In secondary pneumonia the pneumo-coccus was found along with plague bacilli.

21,026. In all the pneumonic cases of plague?—I do not think so; I have seen in primary pneumonic cases of plague only pure cultures of plague bacilli.

21,027. Pneumo-coccus does not occur?—That is so.

21,028. I understand that the impairment of articulation, to which you have referred, is very frequent?—It occurs in about 10 or 15 per cent. of cases.

21,029. It appears to be aphasia?—Yes.

21,030. Is there actual power of articulation or not?—I do not think there is any loss of actual power of articulation, because the patient understands fully what you say, and makes an effort to bring out what he ought to reply, but cannot say it; he might make a certain sound.

21,031. But not an articulate sound?—I do not think he can make any.

21,032. He understands what you say, and tries to say something in reply; but that something which he says is not intelligible?—Sometimes he cannot say anything at all.

21,033. With regard to the temperature which you describe, have you any temperature-curves which will illustrate your statement?—Yes, I can put in a chart.* There are a number of charts attached to the report† here which give the characteristics of the first temperature curves of the epidemic.

21,034. Have you any typical pulse-tracings?—Yes, I have a number of sphygmographic tracings‡ taken by Dr. Galeotti and Dr. Polverini.

21,035. How do you explain the pulse which you have described as being exactly the same as the pulse of aortic regurgitation?—The contractile power of the heart seems to be feeble, and the contraction is not able to expel the full quantity of blood which the ventrical contains; there is insufficient filling of the arteries.

21,036. I understand you to say that this pulse is like aortic regurgitation; do you know if there is actual regurgitation into the left ventrical?—I did not say actual regurgitation, but I saw it resemble it in this way, that the total quantity from the ventricals is not expelled and the arteries are insufficiently full.

21,037. In that case you would not have a large expansion of the artery?—That is so.

21,038. It ought to be a large expansion, ought it not—a large volume of blood projected into the artery?—The volume is much less than one would expect.

21,039. Then it is not a very typical aortic regurgitation pulse. Perhaps you will explain what you learn from the tracings?—Yes.‡

21,040. With regard to the occurrence of blood in the urine, you are quite satisfied that all these cases which you speak of as being cases of hæmaturia actually have blood corpuscles?—Yes; we have examined them and found it was not hæmoglobinuria, but hæmaturia.

21,041. (*Dr. Euffer.*) Could you tell us whether you have noticed any difference in the type of the diseases during these three epidemics?—I find the type of each succeeding epidemic becomes more severe; certainly the type at the present time is more severe than we have ever had.

21,042. Have you ever noticed a difference in the frefrequency of the lung symptoms?—They varied in different periods; at one period the lung symptoms are predominant, at others they are absent.

21,043. Is it so at present?—In the present epidemic the primary pneumonic cases were very frequent, but now we find they are very few.

21,044. Referring again to the cases of aphonia and aphasia, do you find that certain of those cases which, when spoken to, did not try to answer, did absolutely lose the power of even emitting sound?—Yes, they did.

21,045. (*Mr. Cumine.*) Are the cases of *pestis ambulans* confined to a particular season of the year?—No, they occur all through the epidemic, from its rise to its decline.

21,046. (*Prof. Wright.*) Do you find that the severity of the cases goes down towards the end of the epidemic?—Yes, it does.

21,047. You get a larger percentage of recoveries?—Yes.

21,048. (*The President.*) How is relapsing fever modified when it occurs in plague?—I should say that plague is modified by relapsing fever, and the way in which this occurs is very curious. The patient is brought in with all the symptoms of plague, and with bubo; the temperature runs a regular plague course for three or four days, and perhaps remains persistent up to the sixth day, and then we find a sudden drop exactly as in relapsing fever; after the bubo is incised the patient proceeds into convalescence. Then there is an interval between the fall of temperature and relapse. I have at present two or three cases in the hospital which are very typical of that.

21,049. Perhaps you will include these among your charts?—Yes*; *vice versâ* a patient comes in who has relapsing fever with no bubo, and during the apyrexial stage he develops femoral or inguinal bubo and seems to go through an attack of plague. Plague seems to be considerably modified by relapsing fever.

21,050. Then you say pyrexia occurs at a stage when it should have occurred in relapsing fever and not when it usually occurs in plague?—That is so. I should like to put in a statement with regard to the details of the various series of cases treated with Prof. Lustig's serum, as follows:—

TABLE showing the DETAILS of the various SERIES of CASES treated with Professor LUSTIG'S SERUM in 1898.

Months, 1898.	Series.	Horse No.	No. of patients treated.	Died.	Recovied.	Percentage of Recoveries.
		I.				
March - - -	1	1st bleeding	24	18	6	
April - -	4	2nd „	41	30	11	
May - - -	8	3rd „	6	5	1	
August - -	12	4th „	3	1	2	
September - -	15	5th „	16	11	5	
Total - -	—	—	90	65	25	27·77

* *See* App. No. LXIV. in this Volume.

† Report on Bubonic Plague, by K. B. N. H. Choksy, Bombay, 1897.

‡ *See* App. No. LXV. in this Volume. No further explanation (*see* question No 21,039) has been received with these tracings.

Khan Bahadur N. H. Choksy.

22 Feb. 1899.

Months, 1898.	Series.	Horse No.	No. of Patients treated.	Died.	Recorded.	Percentage of Recoveries.
		II.				
April - - -	5	2nd bleeding	13	8	5	
May - - -	9	3rd "	17	6	11	
September - -	13	4th "	12	6	6	
Total - -	—	—	42	20	22	52·29
		III.				
March and April - -	2	1st bleeding	20	11	9	
April - - -	6	2nd "	24	12	12	
May and July - -	10	3rd "	16	6	10	
September - -	14	5th "	10	3	7	
Total " -	—	—	70	32	38	54·28
		IV.				
April - - -	3	1st bleeding	8	3	5	
May - - -	7	2nd "	11	5	6	
July and August - -	11	3rd "	12	6	6	
October - -	17	5th "	12	6	6	
Total - -	—	—	43	20	23	53·48
		V.				
October - -	18	1st bleeding	12	8	4	
Total - -	—	—	12	8	4	33·33
Grand total -	—	—	257	145	112	56·42

There is one point I should like to mention. Three years' experiences at the Hospital gives us an average mortality of 71·44 per cent. The following figures may be of interest to the Commission:—

TOTAL PATIENTS TREATED at the ARTHUR ROAD HOSPITAL up to end of *January 1899*.

3,919—died—2,800 - - -	71·44	per cent.
Died within 24 hours - - -	29·36	,,
Died within 48 hours - -	18·01	,,
	47·37	,,
Recovered under ordinary treatment	28·56	,,
	75·93	,,
Remain which could be influenced by serum - - - -	24·07	,,
	100·00	,,

From these 24·07 per cent. eliminate some that must die after 48 hours, others succumbing either through sudden heart failure, complications, pyæmia, intercurrent diseases, &c., say, about 10·07 per cent., thus leaving only 14·00 per cent. who could be pulled through by the serum.

21,051. (*Mr. Hewett.*) How many die in the first 24 hours?—About 30 per cent., and about 19 or 20 per cent. in the following 24 hours.

21,052. (*Dr. Ruffer.*) Unless you got a serum which acted immediately?—I should say that all these cases were past all hope; they could not possibly be saved except by a miracle.

(Witness withdrew.)

(Adjourned till to-morrow at Poona.)

At The Council Hall, Poona.

FIFTY-FOURTH DAY.

Thursday, 23rd February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Capt J. B. Smith, I.M.S.

23 Feb. 1899.

Captain J. B. SMITH, I.M.S., called and examined.

21,053. (*The President.*) You are in the Indian Medical Service?—Yes.

21,054. What are your medical qualifications?—M.B., M.C.H., and I am also Bachelor of Arts.

21,055. You are also the Civil Surgeon here?—No, I am the Assistant Civil Surgeon.

21,056. You are prepared to give evidence in regard to Karad, I understand?—Yes.

21,057. In the first place, would you tell us how plague originated at Karad?—As far as it is known it was an epidemic that was concealed.

21,058. Can you give us the history of its origin?—In the end of January and the beginning of February 1897, Mr. Young, one of the Survey Department, reported that there were about 13 or 14 cases in the Karad taluka. From that onwards nothing particular happened till the month of March, when the death-rate began to go up. The average death-rate for five years for the town of Karad was 21. The death-rate rose in March to 30, in April it rose to 40, in May it rose to 108, and in June it apparently fell to 52. Major Baker, I.M.S., who was the Plague Supervising Officer, thinks it was due to concealment. In July it rose to 230, in August there were 730 deaths, in September 313, and then it fell in October to 62, in November to 29, and in December to 26.

21,059. What is the normal population of this town?—About 12,000.

21,060. Did you ascertain how plague originated in the town?—No. It was concealed for two months, and it was not notified as plague till the 7th of July. On the 1st of May cholera was notified in the town, and most Medical Officers who have had anything to do with Karad have come to the conclusion that it was not cholera but really plague.

21,061. There was no special means of ascertaining what caused the people to die at that time?—No, except the ordinary Municipal register.

21,062. There was no inspection of corpses?—No, not at that time.

21,063. Having ascertained that there was plague, what did you do?—Before I went there, a Plague Flying Column was sent there on the 13th of July. I did not go there until the 2nd of September, when the epidemic was at its height.

21,064. What had been done before you went?—Search parties were instituted of the ordinary character, and corpse inspection was started. Patients were removed to hospital and their friends were segregated, but no evacuation was carried out.

21,065. By friends, do you mean contacts in general?—Yes.

21,066. There was a special difficulty, you think in the diagnosis of the earlier cases. What was that due to?—It seems to me that very possibly the earlier cases were not bubonic.

21,067. On what grounds?—I have no grounds; it is a hypothesis. I will give you the reason for it afterwards. In the taluka, in the villages round Karad, where plague was in an earlier stage than in Karad, the cases were very largely non-bubonic, so that one would assume it was possibly the same in Karad itself. In several villages I afterwards heard that the earlier cases were non-bubonic. In one village, called Kesa, the earlier cases were always non-bubonic,

21,068. How were these cases known to be plague cases at all?—From their general resemblance to plague—the plague countenance, and the eyes.

21,069. You have seen such cases?—Yes.

21,070. Will you state the grounds on which you came to the conclusion that they were plague cases?—They have absolutely the same appearance as a plague patient, except that there were no buboes—the suffused eyes, peculiar tongue, the stupid expression of the face, the high temperature, and the hot burning skin, and their rapidly fatal termination.

21,071. What is this peculiarity about the tongue?—It is a tongue whitish in the centre, with red edges and tip.

21,072. You are arguing by analogy?—Yes, because probably nobody knows what actually did take place in Karad at first.

21,073. After you came on duty, were the measures extended in any direction?—The measures were very largely extended. The staff of the Plague Column was considerably increased. A large number of coolies were imported from Bombay, some European Inspectors were sent, and also another doctor.

21,074. That is in regard to the staff, but as to the measures themselves, what was the extension?—The only extension was that they were made more perfect. No extra measures were taken; the measures previously in existence were carried out more perfectly.

21,075. Did you ever adopt evacuation on a larger scale than you have described?—No, not in Karad town.

21,076. It was only partial evacuation?—We had no evacuation.

21,077. Only the actually affected people and the contracts were segregated?—Yes. It was in the middle of the rains, and it was extremely difficult. The whole trade of the place was paralysed, and it was practically impossible to get accommodation for the people. We had the greatest trouble in getting accommodation for the ordinary segregation and observation camps.

21,078. In those houses where the inmates had been removed as you have described, what measures did you adopt?—We disinfected them with perchloride of mercury, we opened the roofs, and made large holes in the roofs all along the ridge of the pole, two feet on either side; I took off all the tiles and all the matting underneath, and exposed them to the air and then disinfected them with perchloride spray.

21,079. How long were they left unoccupied?—They were certainly left unoccupied for ten days, the period during which the people were segregated; in the majority of cases they were left longer.

21,080. When re-occupied, did any plague cases occur in these houses?—Not to my knowledge.

21,081. Do you mean that you have no knowledge?—I mean that I should probably have heard of any case. I should have known of any case if it had occurred. There was a case afterwards, in the general disinfection of the town.

21,082. There was a further measure then; what was that measure?—Yes. We did not know what houses were affected in the first instance, and so we commenced at one end of the town, and disinfected right on to the other end.

21,083. About how many houses would that represent?—We disinfected altogether about 2,200 houses before I left, and they were still at it.

21,084. What happened to the inmates of these houses while they were being disinfected?—The inmates had to live in their own verandahs; there was no accommodation for them elsewhere. They refused to go to the segregation camp.

21,085. Were the clothes, and everything in the houses, disinfected?—Everything was disinfected, except things that would be ruined by the perchloride.

21,086. Clothes also?—Yes.

21,087. How was that done?—By perchloride; we steeped everything in perchloride, except woollen and leather goods, which were put out in the sun.

21,088. What was the general result of these measures in so far as the progress of plague was concerned?—The plague went down very rapidly. Here is a chart showing the course of the epidemic. (The witness handed in two charts).*

21,089. In what particular does it show it?—When the measures became effective, the plague mortality and the plague attacks went down. About August the 23th, Major Baker visited the place and got an extra staff, and things were put on a better basis, and from that onwards the death-rate went down, and the attacks went down.

21,090. You had commenced these measures in August?—They were commenced at the end of July first, and they were put on a better basis in the beginning of September. The plague broke out in July, and the plague measures really only began about the end of July. The Plague Column arrived there in July.

21,091. The plague continued to increase?—Yes, until the very end of August.

21,092. While these measures were being carried out?—They were being carried out in an ineffective way.

21,093. Will you describe the difference between ineffective and effective in this case? What do you mean by effective in one instance and ineffective in the other? What was the difference?—Everything was done more thoroughly after the beginning of September. In disinfection, at first, they had too small a number of coolies to overtake the houses infected; after that we got enough coolies to keep pace with the epidemic as it went along. The houses were disinfected within one or two days after they were infected.

21,094. When that was done thoroughly, you think the epidemic began to fall?—It began to fall, but whether it was a coincidence or not, I cannot say.

21,095. Did you find much difficulty in carrying out disinfection thoroughly?—I had the greatest difficulty, extreme difficulty.

21,096. What kind of difficulties?—Unless you are constantly present with your coolies, they have a tendency to shirk their work, partly through laziness and partly through corruption.

21,097. Is there any special difficulty in villages; you refer to that in your précis?—The difficulty of providing European supervision. Unless disinfection is done with European supervision, I do not think it is much good, because these coolies, if you do not watch them continuously, get very careless.

21,098. What kinds of floors had the houses you were dealing with?—Earthen and cow-dung floors.

21,099. Did you do anything more than apply perchloride or other disinfectant solutions to these floors?—No; the floors were not touched, except to soak them with perchloride solution.

21,100. The walls and the ceilings also?—The walls, and the ceilings, the floors, the furniture, and everything was taken out of the house that could be removed, and before returning, they are put through solution.

21,101. What did you regard as the chief channel of infection?—I cannot give any opinion on that.

21,102. Have you any idea as to any channels of infection; how is the plague communicated from one person to another?—It seems to be a local infection of the house, but I had no leisure at the time to follow up the cases one by one.

* *See* App. No. LXVI. A, and B, in this Volume.

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21,103. You have no instances in which it seemed to be conveyed, for example, by one person to another?—No. I had one instance where it seemed to be conveyed by furniture, but as the people were related to one another, of course there is a flaw in the argument. The family got plague in the house before disinfection. After the people had been taken to the hospital they sent some of their furniture to a brother-in-law's house and in about four or five days some people in this house got plague. But then that may not have been by the furniture, as they were nearly related.

21,104. They may have come into personal contact with one another?—Yes. That is the only instance I know of communication by furniture apparently.

21,105. Have you any instance as to the conveyance by animals of the infecting virus?—No, all the rats were dead at the time I got there.

21,106. You had some experience with Yersin's curative serum?—Yes.

21,107. Would you detail that experience?—There are 32 cases treated. I propose to hand in a statement showing the details.

21,108. Perhaps you will summarise them?—There are 32 cases treated, and of those 21 died. There were two cases which were doubtful as to whether they were plague or not, and two were very mild cases.

21,109. These recovered?—Yes. The statement is as follows:—

STATEMENT of CURATIVE INOCULATIONS performed by DR. SIMOND, at KARAD, with M. YERSIN'S SERUM.

Serial No.	Register No.	Names.	Age.	Sex.	Caste.	Street.	Date of Admission.	Date of Death.	Date of Discharge.	Dr. Simond's Notes.
1	639	Chandra Subhana	9	Female child.	Mahratta	Mangalwar Pet.	5.9.97	7.9.97	—	Bubon inguinal droit et pneumonie 2e jour de la maladie, cas très grave, 40cc. sérum en 2 fois.
2	638	Datto Ram Krishna	7	Male child.	„	Somwar Pet.	„	5.9.97	—	Bubon axillaire et pneumonie à droit 2e jour de la maladie, cas très grave, 15cc. de sérum injecté 6h. avant la mort.
3	639	Krishna Mahadeo	32	Male	„	„	„	6.9.97	—	Bubon inguinal droit parotide embarrassée, 2e jour, cas très grave, 60cc. de sérum en 2 fois.
4	643	Shita Kom Pandoo	25	Female	„	Karad	6.9.97	8.9.97	—	Bubon axillaire et bubon cervical 3e jour de la maladie, cas très grave, 60cc. sérum en 2 fois.
5	649	Dhond Bhat Manikhat	50	Male	Brahman	Guruwar Pet.	„	9.9.97	—	Pneumonie double, pas de bubons, 2e jour de la maladie, cas très grave, 90cc. sérum en 4 fois.
6	647	Bhima Kom Natha	30	Female	Mahratta	Karad	„	7.9.97	—	Pneumonie à droit, et petit bubon inguinal aphasie 2e jour, cas très grave, 40cc. de sérum en 2 fois.
7	650	Shindoo Rama	39	Male	„	„	„	—	5.10.97	Bubon inguinal droit 4e jour de la maladie, cas léger, 20cc. de sérum injecté à sa demande sans nécessité.
8	648	Kasai Kosh	60	Female	Weaver	„	„	13.9.97	—	Bubons cervicaux, bubons axillaires et inguinaux, 3e jour, cas très grave, 50cc. de sérum en 3 fois.
9	657	Yesoo Ramchandra	14	„	Mahratta	„	7.9.97	„	—	Bubon inguinal droit, coma, 2e jour de la maladie, cas très grave, 30cc. de sérum en 2 fois.
10	658	Dnyanoo Jivaba	50	„	„	„	„	7.9.97	—	Bubons cervicaux et pneumonie 3e jour de la maladie, cas très grave, 30cc. de sérum en 1 fois injecté 7h. avant la mort.
11	652	Bahiru Narayen Kosti	21	„	Weaver	„	„	—	15.9.97	Jeune homme auquel j'ai pris du virus dans le bubon. Bubon inguinal à gauche 2e jour, cas très grave, avec stupeur et mutisme, 60cc. de sérum en 3 fois.
12	654	Chandra Sakharam	20	Female	Mahratta	„	„	10.9.97	—	Bubon cervical et bubon inguinal 2e jour, cas très grave avec coma, 80cc. de sérum en 3 fois.
13	681	Govind Gopala	38	Male	„	„	8.9.97	„	—	Peste intestinale, pas de bubons ni de pneumonie 3e jour, cas très grave, stupeur et aphasie, 30cc. de sérum.
14	680	Keshoo Rajoram	30	„	„	„	„	—	6.10.97	Pas de bubon ni de pneumonie, fièvre forte 3e jour, cas douteux, 40cc. sérum en 2 fois.
15	684	Radha Maruti	24	Female	„	„	9.9.97	11.9.97	—	Bubon axillaire et stupeur profonde, 2e jour, cas très grave, 40cc. de sérum.
16	688	Kashi Kom Tukoram	18	„	Bhoijee	Bhoijeelane	„	9.9.97	—	Bubon inguinal et stupeur absolue 2e jour, cas très grave, 30cc. serum.
17	691	Ganoo bin Vithoba	20	Male	Mahratta	Karad	10.9.97	15.9.97	—	Bubon inguinal, délire, 4e jour, cas très grave.
18	693	Manjula Yessoo	25	Female	„	„	„	—	5.10.97	Bubon inguinal 2e jour, cas de gravité moyenne, 40cc de sérum en 2 fois.
19	704	Yema Kom Rama	20	„	„	Mangalwar Pet.	11.9.97	15.9.97	—	Bubon inguinal 2e jour, cas très grave, 30cc. sérum.
20	711	Walli Mohamed	60	Male	Musalman	„	12.9.97	—	7.10.97	Bubon inguinal droit 2e jour, cas de gravité moyenne, 40cc. sérum en 2 fois.
21	717	Chandra Sakhoram	20	Female	Mahratta	Karad	14.9.97	—	17.11.97	Bubons inguinaux à gauche et à droit 2e jour de la maladie, cas très grave avec stupeur et mutisme, 80cc. sérum en 3 fois.
22	708	Bhagoo Kom Hari	18	„	Sali	„	„	15.9.97	—	Bubon inguinal gauche, coma, 4e jour, cas très grave. Peste contractée dans l'hopital, 30cc. sérum.
23	724	Kashinah Mahadeo	30	Male	Brahman	Mangalwar	„	—	12.10.97	Bubon inguinal 2e jour, cas grave, 20cc. de sérum en 4 fois.
24	735	Appa Sakhoram	50	„	„	Somwar	15.9.97	—	17.10.97	Ni bubon ni pneumonie, fièvre forte, 105°, cas douteux, peut-être peste intestinale légère, 40cc. sérum en 2 fois.
25	743	Mahadeo Babajee	23	„	Mahratta	„	16.9.97	22.9.97	—	Peste intestinale sans bubons ni pneumonie 2e jour, cas très grave avec stupeur et délire, 70cc. de sérum en 3 fois.
26	753	Radha Kom Rama	25	Female	„	Karad	17.9.97	—	6.11.97	Bubon inguinal gauche 1e jour, cas très grave avec stupeur et convulsions des fièvres nutisme, 80cc. de sérum en 3 fois, parait evolver vers la guérison.
27	757	Moruti bin Nathajee	28	Male	„	„	18.9.97	21.9.97	—	Bubons cervicaux à droit et à gauche 1e jour, cas très grave, 60cc. sérum en 3 fois.
28	763	Haribai Narayen	55	Female	Hindu	Somwar	19.9.97	19.9.97	—	Bubon axillaire 4e ou 5e jour cas très grave avec faiblesse extrême du cœur, 30cc. sérum quelques heures avant la mort.
29	772	Sukhina Kom Shaku	44	„	Musalman	Karad	21.9.97	—	22.10.97	Bubon inguinal gauche petit et indolent 3e jour, cas de gravité médiocre, 40cc. de sérum en 2 fois.
30	778	Kondai Ganoo	40	„	Hindu	„	22.9.97	30.9.97	—	Bubon inguinal droit 2e jour, cas de gravité moyenne, 40cc. de sérum.
31	781	Bhagirathi Kom Krishna.	32	„	„	„	„	—	24.9.97	Bubon axillaire gauche 2e jour, cas léger, 10cc. de sérum injecté sur sa demande sans nécessité.
32	785	Tukoram Babajee	14	Male	„	„	24.9.97	24.9.97	—	Bubon inguinal droit, coma, 3e jour, cas très grave, 30cc. sérum quelques heures avant le mort.

STATEMENT showing the PERSONS who got PLAGUE after being INOCULATED by Dr. SIMOND at MASUR, &c.

No.	Name.	Age.	Sex.	Caste.	Occupation.	Date of 1st Inoculation.	Date of 2nd Inoculation.	Date of Attack with Plague.	Date of Death.	Remarks.
1	Vishnoo Ganesh Bapat	22	Male	Hindu	Hospital Assist.	10.9.97	—	1 .10.97	16.10.97	
2	Parashram Balwant Fadke	25	„	Brahman	P. Candidate	„	—	14.10.97	„	
3	Rama Raju Bhosle	45	„	Mahratta	Labourer	„	—	—	—	Was attacked, but recovered.
4	Ganoo Babajee	18	„	Hindu	Watchman	„	—	16.10.97	19.10.97	
5	Bala Wald Hasan Faral	26	„	Musalman	Taral	„	—	10.10.97	15.10.97	
6	Gangadhar Jaganath	38	„	Hindu	Postmaster	25.9.97	—	15.10.97	20.10.97	
7	Wasudeo Sdonm Khandeker	32	„	„	Schoolmaster	„	—	24.10.97	27.10.97	
8	Dhondi Rama	25	„	Wani	Trader	„	—	—	—	Was attacked with plague.
9	Ramchandra Narayen	23	„	Hindu	„	„	—	—	—	Out cured.
10	Gundoo Bhiyanga	20	„	„	„	„	—	11.10.97	19.10.97	
11	Bali Rawjee Patil	39	„	„	Farmer	„	—	20.10.97	25.10.97	
12	Parshotam Narayen	45	„	„	Trader	„	—	—	—	Died at Kalgoon.
13	Krishna Keshao	16	„	„	„	„	—	7.10.97	14.10.97	
14	Duyanoo Mathari	10	Child	„	Schoolboy	„	—	2.11.97	7.11.97	
15	Shauker Narayen Tate	7	„	„	„	„	—	26.10.97	1.11.97	
16	Narayen Vasoodeo	7	„	„	„	„	—	18.10.97	—	Recovered.
17	Wanan Chuitamau	45	Male	„	Trader	„	—	—	—	Attacked with plague and recovered.
18	Krishna Ganpata Teli	35	„	„	„	„	—	27.10.97	2.11.97	
19	Rama Gundappa	30	„	„	„	„	—	—	—	Had plague, but recovered.
20	Heri Kom Lawla	35	Female	„	Nil.	„	—	21.10.97	26.10.97	
21	Rama Krishna	38	Male	„	Cultivator	„	—	23.10.97	27.10.97	
22	Damodher Govind	12	„	„	Kulkarni	„	—	23.10.97	1.11.97	
23	Bagoo Antajee Aphale	7	Child	„	„	„	—	18.11.97	22.11.97	
24	Aki Tukaram Gujar	7	„	„	Nil.	„	—	6.9.97	10.11.97	
25	Wulli Pandoo	6	„	„	„	27.9.97	—	3.10.97	9.10.97	
26	Dhowbhai Wuld Mohidin	45	Male	Musalman	Cultivator	„	—	21.10.97	26.10.97	
27	Pandoo Joti Matane	25	„	Mahar	„	„	—	6.12.97	10.12.97	
28	Hasan Wald Hajarat	7	Child	Musalman	Taral	„	—	6 11.97	7.11.97	
29	Rajoram Sakhoram Sutar	12	Male	Mahratta	Carpenter	„	—	13.10.97	16.10.97	

21,110. (*Dr. Buffer.*) Where was the serum used?—In Karad town.

21,111. (*The President.*) Was it used in the hospital?—Yes.

21,112. Did you apply it?—No. Dr. Simond applied it.

21,113. Do you know the details?—More or less.

21,114. Do you know what dose was given?—The dose is all given in the statement, which also gives Dr. Simond's own notes on the subject.

21,115. What was the general result in your opinion?—That it was ineffective, and of no use.

21,116. What was the mortality?—The mortality was as bad (65·6 per cent.) as the average hospital mortality.

21,117. The mortality was greater than the average hospital mortality?—Dr. Simond's cases were, perhaps, better diagnosed than our general Plague Hospital statistics. I should say the mortality rates were about the same.

21,118. Have you had some experience of prophylactic treatment?—Yes. I have very little experience about Haffkine's. In Karad town and the districts we did 136 cases altogether, and so far as I know none of those people got plague.

21,119. You guard yourself; have you not been able to follow the history of these persons?—The ones in Karad up to the time I left had not got plague. I know about 101 up to the time I left Karad that had not got plague.

21,120. How long after inoculation would that be?—A varying period; some were inoculated a fortnight before I went away, and some were inoculated very much earlier than that.

21,121. How much? What was the longest interval and what was the shortest?—I should say about a month and a half or two months, probably. Of course we commenced inoculating at the time when plague was practically over in Karad.

21,122. This was the period of the fall of the plague?—Yes, at the end of the plague.

21,122. About when was that?—About the middle of November the death-rate in the town was down to normal. The reason these people were inoculated was that they wanted to go out into the infected villages for trading purposes. Sixty-one people got inoculated on that ground.

21,124. What is your opinion of the value of that evidence as showing whether there was any protection produced or not?—I should think, as there were 61 people who went backwards and forwards to infected villages, they stood a very good chance of getting plague if they had not been inoculated.

21,125. Are you aware of any number of people who were not inoculated, who also went backwards and forwards between the villages?—You will see them marked in the upper chart.* Those cases that occurred, the imported cases, were amongst the uninoculated people who went backwards and forwards.

21,126. Do they represent a larger proportion than those actually inoculated?—I should say they represented about the same.

21,127. (*Mr. Hewett.*) I do not know whether you stated the population of Karad?—It was about 12,000 in 1886.

21,128. Was there an Assistant Surgeon there when plague broke out?—There was a Hospital Assistant.

21,129. I suppose he had not had any previous opportunity of seeing a case of plague?—No.

21,130. Apparently plague went on till the end of January 1898?—Dropping cases, yes. Most of them were imported as you will see by the upper chart.*

21,131. I see that the curve goes up and down almost evenly. The epidemic went up to a certain point, and then down again. The descending line is very like

* *See* App. No. LXVI. A in this Volume.

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the ascending line. Do you think that this indicates that the suppression of the epidemic was clearly due to the measures taken?—Only this, that when measures began to be very thorough the epidemic began to go down; it is a coincidence.

21,132. When do you think that the measures began to be done very thoroughly?—I should say about a week after I went there.

21,133. When was that?—I went there on September the 2nd.

21,134. The plague had already begun to decline?—It had, but Major Baker had been there before me, and he had the searching done more thoroughly.

21,135. When did he go there?—On the 26th of August. A slight decline took place at once.

21,136. But starting from the week ending the 26th of August which was the week of the maximum number of attacks there were 518 attacks in the four preceding weeks, and 479 in the four succeeding weeks; do you think those facts show that it was the measures that caused the epidemic to decline?—All I can say is that it is a coincidence, if they have nothing to do with it.

21,137. Would you expect that the decline would be more rapid if it was the result of the measures taken?—No, I do not think so.

21,138. What is the particular measure to which you attribute the decline of the epidemic at Karad?—I consider disinfection had the great effect, and taking the contacts out of their houses.

21,139. Have any of the houses which were disinfected in Karad become re-infected?—They have within the last month or two.

21,140. Have you been able to trace this re-infection to people coming from other places?—I have nothing to do with Karad now, but I have been told by people on the spot that they have been infected by people in the Pathan taluka.

21,141. Does your experience at Karad show, in your opinion, that in order to suppress an epidemic of plague, it is not necessary to insist upon evacuation of the place?—If I have to go back to Karad, and at a suitable time of the year, I should prefer evacuation.

21,142. On what ground?—On the ground of the effect it had in villages. People were turned out of the villages by executive order, as soon as the rains had subsided, and the death rate went down very rapidly.

21,143. (*The President.*) I understood you to say you had no experience of complete evacuation?—That was in charge of the Medical Officer who actually did the work, and I only dealt with the subject as his superior officer. He is at home now, so he cannot be called.

21,144. (*Mr. Hewett.*) Were these villages evacuated during the rains?—They were evacuated immediately after the rains. They were evacuated partly by the will of the people themselves. As soon as the rains ceased they went out into their fields.

21,145. Do not you think that evacuation on black cotton soil is very difficult to effect during the rains?—That was the difficulty in dealing with the people in Karad and the villages during the rains; it was impossible to do it.

21,146. When you evacuated these villages after the rains were the people whom you turned out allowed to go where they liked?—They were in most villages.

21,147. Do you think that was a good plan?—I think there is a great risk of their going to other villages.

21,148. But you think it is a good thing to get them out of the infected site?—Yes. There are two kinds of villages that one must take into account; agricultural villages, and commercial villages. The agricultural villagers are not likely to leave their village, they are accustomed to go out and live in their fields in the cold weather, and in the dry season, and they have no particular object in going off to other villages; whereas in commercial villages weavers, for instance, cannot carry on their trade in the fields, and they must go to some place where they can get a house.

21,149. Does that chart* show the results of the evacuation of these villages?—I think so. One shows the rainfall, and the other the course of the epidemic. You must make allowance in these charts, however, for the fact that the returns are made by the village officers, who are very slow in sending in their information with regard to plague. But as soon as the rain ceased the epidemic went down, in about three weeks I think.

21,150. Did you observe any instance in which a village having been evacuated, because a particular portion of it was infected, the inhabitants, on returning to the village, got plague in other portions of it?—I think, as a matter of fact, the whole of the village was evacuated. The Second Assistant Collector, who was the Chief Plague Authority, issued an order that they were to clear out, and they did, into the fields. There was no partial evacuation at all.

21,151. I was asking about what happened when the people were allowed to go back to their villages?—I was not there then.

21,152. Were the villages entirely disinfected?—They were supposed to be.

21,153. Did not you find that a difficult process in a village?—Yes, it is almost impossible in the villages.

21,154. Why?—Because you have to trust to people of a very low social scale who are very open to bribes, and who in many cases are careless about the process, and think that things are of no importance which might really be of great importance.

21,155. Do you think that it is essential to disinfect the roof of a house?—That I am not in a position to say. I am not a bacteriologist.

21,156. Do you think that it is possible to disinfect the roof of an ordinary house in a village?—I do not think it is possible to do it thoroughly; I am almost certain it is not. What I should propose to do in a village, as soon as a plague case is reported, is to have the house in which it occurred immediately unroofed. In a village you have not any police, as a rule, except the ordinary village police, and it is impossible to make certain that the people do clear out of the infected houses. But if you take the roof off, I do not think it matters very much whether the people live in the house or not; they would have lots of fresh air and sunlight.

21,157. Do you know whether the villages which were infected in Satara in 1897, have become re-infected now?—As a matter of fact I do not think they have ever been absolutely free since.

21,158. (*The President.*) Were those villages evacuated?—Yes.

21,159. (*Dr. Ruffer.*) Can you point out on this chart the day when the evacuation took place?—I am sorry I cannot give you the order, but as soon as the rains were over the people began to clear out at once, partly of themselves to attend to the cultivation of their fields.

21,160. Looking at this chart it would appear that 10 weeks elapsed before the disease disappeared?—Yes, but it went down with a run. The fair weather began in the week ending November the 6th.

21,161. When did the disease almost disappear?—The lowest figures are for January the 15th.

21,162. How many weeks is that?—Ten weeks.

21,163. How long did it take in the village where no evacuation took place?—Seven weeks.

21,164. That is seven weeks as contrasted with 10?—Yes.

21,165. What then is the benefit of evacuation?—It is possible to carry it out effectively, while it is not possible in villages to carry out disinfection.

21,166. You said you stopped the epidemic quicker by evacuation, but, in this case, the epidemic seems to have stopped quicker by disinfection?—I believe you can improve upon that by adding evacuation to disinfection.

21,167. Why do you think so?—Because you have the people absolutely away from the infected site.

21,168. But in the infected villages it took a longer time?—As I told you, it took some time for the people to clear out, to make certain that the rains had stopped. Those are the weeks that are reported at the Mamlutdar's office, and it takes the village officers a certain amount of time to send them in. They are very slow in sending in a document of that kind, so you must allow those returns to represent, I should think, two weeks earlier.

21,169. You saw the cases treated by Dr. Simond?—Yes.

* *See* App. No. LXVI. B in this Volume.

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21,170. I see he mentions two cases of intestinal plague. Have you any experience of that form of plague?—No, not except what he has there. I should have called that the ordinary non-bubonic form.

21,171. Septicæmic plague?—Yes, septicæmic plague.

21,172. Have you ever seen a case of what you might call intestinal plague, where the intestinal lesions were very clearly marked?—No, I cannot say that I have.

21,173. Have you any experience of plague *post mortem*?—No.

21,174. (*Prof. Wright.*) What inducement has a villager to offer bribes to a disinfecting coolie?—To save his kit being put into perchloride solution.

21,175. Does that spoil the clothes?—It does not spoil cotton clothes, but it spoils woollen clothes, and it spoils leather.

21,176. (*The President.*) In those villages that you have referred to, what was the time occupied in effecting evacuation?—That I could not tell you. It was left to the village officers to turn the people out, and in some villages they would be quick, and in others slow. It was done simply by an order of the Second Assistant Collector, and issued to village officers.

21,177. You have no personal knowledge?—No.

21,178. How do you know they were ever entirely evacuated?—I heard it from the Medical Officer who was under me, and from the Assistant Collector.

21,179. So far as you know, how long did it take?—I would rather not answer that question; I do not know.

21,180. It may have been a very long time or a very short time?—I should think it was within a fortnight in all cases, perhaps less.

21,181. What means were taken to prevent evacuated persons from returning to the houses in the village or villages?—The village officers were supposed to prevent that, and that is the weakness of the system; you have to trust so much to village officers in these matters.

21,182. You do not think that is an effective method of preventing the return; you think they probably did come back?—It is not an effective measure, and I think that people probably did come back every now and then. They would give a rupee or so to the village officer and go back for kit, or to stay in the house.

21,183. You cannot present these as a model example of evacuations; there were a great many flaws in the process?—No, I do not present them as a model example. There were a great many flaws. There were no means to prevent the people going to other villages, which is a very great flaw, in my opinion. There was one village which was taken in hand by Dr. Robertson. He passed all the people out of the village through an observation camp, and allowed them to go anywhere. He then got all the village disinfected, and he brought them in again in the same way through the observation camp, and that village remained uninfected and I believe it is still uninfected.

21,184. You think that plague was stopped in the first case?—Yes, and so far as I know, it has not occurred again in that village.

21,185. Within that time, was it stopped among the evacuated?—I think there was only one or two cases among the evacuated altogether.

21,186. Have you got any figures?—I cannot give any figures. This was a year and a half ago, and I am now away from my office, and I have no means of procuring those figures.

21,187. You have no access to the records?—No.

(Witness withdrew.)

Lieut.-Col. W. J. FAWCETT, R.A.M.C., called and examined.

Lieut.-Col. W. J. Fawcett, R.A.M.C.

21,188. (*The President.*) You are in the Royal Army Medical Corps?—Yes.

21,189. And you can give us evidence about Poona and Kirki?—About Poona and Kirki cantonments, and the suburban Municipality from the commencement of work by the Committee formed by Government under the Presidency of General Duncan, on the 17th November 1897 up to August last, when I left the Committee. But plague had ceased in the portions of the country under our control about the 11th of March, which was the date of the last case.

21,190. (*Dr. Ruffer.*) Could you tell us what the population of the Poona cantonment was at the beginning of the plague epidemic?—It was believed to be between 25,000 and 30,000 people.

21,191. When was the last census taken?—That I could not say. The above was the information I received at the time.

21,192. What was the population in Kirki cantonment?—The cantonment bazar about 2,000, and the followers of the Royal Artillery 1,700; but that is merely a rough guess.

21,193. Plague appeared first in the Poona cantonment on the 27th of June, did it not?—Yes.

21,194. There are two cases among the followers of the 2nd Bombay Lancers?—Those were the first recorded cases.

21,195. Have you any reason to believe that there was plague before that?—I was not present at the time. I fancy it is very probable that there were cases of plague before that.

21,196. Why?—From what I have seen of the difficulty of diagnosing first cases of plague.

21,197. You say in your précis of evidence, "On the 2nd of July a sawar was attacked." What is a sawar?—A sawar is a trooper of a Native Cavalry regiment.

21,198. On the 4th there were three cases, on the 5th, one child, and on the 6th, two sawars and two children, all in the 2nd Bombay Lancers?—Yes.

21,199. You have been told that the disease "had "been imported with grain purchased by the regiment "in Bombay." Could you give us any evidence as to that?—Not the slightest evidence. It is contained in a Report* made by the late General Duncan, and when writing the report on plague in Poona I did not feel myself justified in altering it in any particular. I do not hold myself responsible for that statement. At the time it met with general approval.

21,200. (*The President.*) Does that apply to the whole of this Report*?—Not to the whole of it, only to the first five pages. The foregoing is a statement with which I do not agree. I see no grounds for agreeing with it.

21,201. (*Dr. Ruffer.*) Why not?—My experience of plague leads me to believe that it is not at all probable that grain will carry the germ of plague for any considerable length of time.

21,202. In this particular instance?—In this particular instance I know that plague existed in the villages around the cantonments, although I cannot prove it, before June. I know it from my experience in talking to the villagers, and in the bazars afterwards, that there was plague in the surrounding country before that.

21,203. Then the plague spread to other squadrons of Cavalry in the cantonments, did it not?—In the Cavalry lines in the cantonment, yes.

21,204. Can you tell us when the first cases occurred in the chawls in the borders of the lines?—I could not. I was not present.

21,205. Have you any evidence to shew that there were cases in the chawls before the regiment was attacked?—None whatsoever.

21,206. Could you tell us whether there had been plague in the Kirki bazar during that time?—There were no cases in June. In July there were cases in the bazar in Kirki. There had been three cases in May, but none reported in June.

21,207. Do you think that these were really the first cases, or only the first cases that were noticed?—I think they were the first cases that were noticed, but that must be a matter of opinion.

* "Report on Plague in Poona and Kirki cantonments and suburban limits from 17th March 1897 to 19th March 1898," by Lt.-Col. W. J. Fawcett, not reprinted with the Proceedings of the Commission. The opening portion of this report had been written by Lt.-Gen. J. Duncan.

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21,208. On the 7th August disease broke out in the Royal Artillery followers' lines?—Yes.

21,209. And these followers were moved block by block into the health camps?—Yes.

21,210. Were the lines disinfected?—They were disinfected; at least, it is reported so.

21,211. How?—By the use of perchloride of mercury, I understand.

21,212. You did not do it yourself?—I was not there at the time.

21,213. Did any cases of plague re-occur when the regiment went back to those lines?—In Kirki. I think it would be better for me not to answer that definitely because I was not there, and the records kept at the time were extremely confused, and any information I could give you that I derived from records would be practically worthless with regard to that portion of the epidemic in Kirki about the re-infection.

21,214. Why do you think it is worthless?—I have seen the records, and I have conversed with men who were working at the time before the appointment of Major Temple. They were overworked; it was raining night and day, and there was a scene of confusion; there were not sufficient hands and there were not sufficient heads.

21,215. Major Temple assumed charge on the 20th of August?—Yes.

21,216. Can you tell us what measures he enforced?—He commenced by instituting search parties, which were very carefully carried out indeed, that is to say, I think from the time he commenced work it would have been impossible to conceal a case within the limits of the cantonment. The bazar at that time was almost deserted; instead of containing 2,000 there was not probably more than 600 people in it; the lines were being evacuated at the time.

21,217. What had become of the 4,000 people?—The other 1,600 people. There were 2,000 inhabitants of the bazar alone who fled here and there throughout the country—melted away. It would be almost impossible for a case of plague to exist for 24 hours without being discovered under Major Temple's arrangements. On discovery of a case it was at once sent to the hospital, the whole of the inhabitants of the house were at once placed in segregation camp, and the house immediately disinfected with very elaborate disinfecting arrangements—quite a toilet—and I think that constitutes practically the whole of his arrangements.

21,218. The houses were disinfected with perchloride of mercury?—Yes.

21,219. How long did the people remain in segregation camp?—10 days.

21,220. They were then allowed to go back to their houses?—Yes.

21,221. When were the last cases of plague under this system in Poona cantonment?—The last case of plague occurred on the 11th of March, but practically the last indigenous case occurred in Poona cantonment about the 28th or 29th of December.

21,222. The epidemic in Kirki was practically at an end in September, was it not?—Yes.

21,223. Did the neighbouring villages get infected?—All the villages in the immediate neighbourhood were infected.

21,224. How many?—There were practically only two near Kirki, and they were both infected.

21,225. What were the names of the villages?—They are two small villages near the cantonments; their names are not given on the map I have.

21,226. There was some plague among the Royal Artillery followers in Kirki, was there not?—Yes, there was very severe plague indeed amongst them.

21,227. How many followers are there, and how many died?—There are about 1,700 followers, but the number that died is uncertain. The families are continually varying in numbers.

21,228. In August there was a total of 181 cases and 80 deaths among the followers?—Yes.

21,229. Did you perform any inoculations among the followers?—Inoculations were performed.

21,230. When?—That I cannot tell you. I have seen the records, and I had hoped to lay the particulars before the Commission, but I regret to say that the records are valueless. The only Medical Officer there was was overworked at the time. He inoculated the people it is true, and he endeavoured to follow the course of the life-history of those people afterwards, but the results he arrived at are so widely different from those arrived at by other people that I decline to produce them.

21,231. How many did he inoculate? Does he know that?—No.

21,232. Does he know how many deaths occurred amongst those who were known to be inoculated?—I have not got the records with me, and I can only say that it was impossible to arrive at any exact conclusion. There were numbers of pieces of paper with the same names repeated.

21,233. So that you think the whole of the figures are valueless?—Yes. I think the figures are valueless. The conclusions are different from those arrived at by Prof. Haffkine. They are valueless in my opinion.

21,234. Could you give us the figures as they are?—I can ask for the records, and bring them if you wish. They are not in my possession at present.

21,235. In whose possession are they?—They are in the possession of the Deputy Assistant Adjutant-General of the Poona District.

21,236. Can you give us any information about the Bombay Sappers and Miners in Kirki?—The Sappers and Miners were not infected until much later than the followers of the Royal Artillery. Their lines are situated on the other side of the river. They had dropping cases amongst them.

21,237. What is the number of the Bombay Sappers and Miners?—I could not actually say; I should think about 700.

21,238. They had three men, two women, and six children attacked, had they not?—Yes.

21,239. Eleven cases and nine deaths?—Yes.

21,240. Were any inoculations performed among the Bombay Sappers and Miners?—No.

21,241. When were the Bombay Pioneers attacked?—The 28th Bombay Pioneers were also attacked in October, and the last case occurred on the 26th of December. Seven men, nine women, and seven children suffered. There were 20 deaths.

21,242. Were the Royal Artillery followers or the native troops sent out of their lines, or did they remain in their lines?—The Sappers and Miners and the 28th Bombay Pioneers were camped out. They had a few cases among them. The result was eminently beneficial. Three cases occurred among the 28th Bombay Pioneers after they were camped out.

21,243. How many cases had they had before?—Seven men, nine women, and seven children; and deduct three patients from the total.

21,244. How many cases were there among the Bombay Sappers and Miners?—Only two cases occurred after they went out. One of those was a man who was engaged in whitewashing in the infected lines.

21,245. How soon after evacuation did these three cases of plague occur?—As regards the depôt of the 28th Pioneers—the camp was formed on the 28th October 1897. Cases after 1st November 1897 occurred as follows: one soldier on the 12th November, one Bannah on the 23rd November, and one soldier on the 25th December. As regards the Bombay Sappers and Miners—the camp was formed on the 7th January 1898. One case occurred on the 7th January and one on the 22nd January.

21,246. You had a Plague Hospital in Kirki, had you not?—Yes.

21,247. We will now return to the Poona Cantonment. Poona Cantonment was re-infected on the 9th of August, was it not?—Yes, it was said to be re-infected then.

21,248. It was supposed to have been re-infected from Kirki, was it not?—Supposed to have been.

21,249. Do you think it was actually re-infected, or do you think plague has been going on?—I have no doubt it was re-infected. I fancy that there were dropping cases of plague in the supposed interval between May and August.

21,250. In the interval between May and August was there anything like corpse inspection or search parties?—I was not here at the time, and I am not quite certain whether there was corpse inspection or not. My personal experience only began late in October.

21,251. Can you tell us anything about plague among the troops, Native or otherwise, in the cantonment?—The disease first attacked the troops in cantonment on 28th September; on that date two cases occurred in the 19th Bombay Infantry; on 29th another case occurred in the same regiment, and six in the 2nd Grenadiers; prior to this, however, there had been some cases in the bazar of the 2nd Grenadiers, quite a village, being very much overgrown and overcrowded. On this date, 29th September, both regiments were moved into camp on the Poona Racecourse. As cases continued to occur after these regiments moved into camp, the camp of the 19th Bombay Infantry was moved on to the top of Gibbet Hill on 15th October, and that of 2nd Grenadiers to the foot of Gibbet Hill on 23rd October; three cases having occurred in the lines of the depôt of 14th Bombay Infantry, on 27th October they likewise were moved into camp on Gibbet Hill.

21,252. How many cases occurred after these regiments were removed into camp, and what were the dates of the recrudescence of each case?—The particulars are as follows:—

2nd Bombay Grenadiers. Encamped on Racecourse, 29th September, 1897.

1st October	- -	One case in a child.
3rd ,,	- -	,, ,, woman.
3rd ,,	- -	,, ,, child.
10th ,,	- -	,, ,, boy.
13th ,,	- -	,, ,, follower.
18th ,,	- - -	,, ,, ,,
21st ,,	- -	Four cases in soldiers.
22nd ,,	- - -	One case in a woman.

Camp moved 23rd October.

14th November	- -	One case in a soldier.
15th ,,	- -	,, ,, woman.

Depôt 14th Bombay Native Infantry. Encamped on the 28th October, 1897.

5th November	- -	One case in a child.
5th ,,	- - -	,, ,, follower.
6th ,,	- - -	,, ,, child.
10th ,,	- - -	,, ,, ,,
18th ,,	- - -	,, ,, woman.

Camp moved further from cantonments.

19th Bombay Native Infantry. Encamped on Racecourse, 29th September, 1897.

30th September	- - -	2 soldiers.
1st October	- - -	3 ,,
2nd ,,	- - - -	1 woman.
3rd ,,	- - - -	1 soldier.
3rd ,,	- - - -	1 woman.
7th ,,	- - - -	1 child.
11th ,,	- - - -	1 soldier.
12th ,,	- - - -	1 ,,
12th ,,	- - - -	1 woman.
13th ,,	- - - -	1 soldier.
13th ,,	- - - -	2 women.
13th ,,	- - - -	2 children.
14th ,,	- - - -	1 soldier.
14th ,,	- - - -	1 woman.

Camp moved 15th October, 1897.

15th October	- - -	1 follower.
17th ,,	- - -	1 soldier.
21st ,,	- - -	1 ,,
22nd ,,	- - -	1 ,,
24th ,,	- - -	1 ,,
28th ,,	- - -	1 ,,
10th November	- - -	1 ,,

These regiments were sent into camps without any disinfection of clothing or kit, as they were moved into tents.

21,253. Had there been any disinfection among any of these regiments?—No; they were marched out without disinfection of any kind. The following additional precautions were taken after moving these camps: each corps had a Banniah with it in camp who was required to purchase weekly the grain required for the men, and not to issue it until it had been exposed to the sun and air for 24 hours; the guards over the lines were on duty for a week, and during that time were not allowed to enter the Quarter Guard or any of the buildings, but were accommodated under canvas, and on being relieved were segregated for another week before being allowed to rejoin their regiments; as cases still continued to occur it was thought that this was due to the families visiting the bazar, and therefore the next precaution was to move the families away from the men and further from the bazar, and also to place guards over them, to prevent them leaving their camp. No further cases occurred amongst these Native Infantry regiments after this last precaution.

21,254. I believe plague broke out in the Transport lines among the followers?—Yes. Plague broke out in the Transport lines among the followers and their families, about 400 strong, on 5th October, and up to 4th November 24 cases had occurred; on that date the whole of the followers and their families, numbering altogether about 400, were moved into camp near the rifle range, but as 14 more cases occurred, arrangements were made on 13th November to move the camp a few yards to the front across the main road running parallel thereto. Each tent was sprayed with perchloride of mercury solution, then carried across the road and put up; the followers and their families including even their cats and dogs, their cocks and hens were carefully disinfected before being allowed to cross the road and re-occupy their tents; the experiment was eminently successful, for after that date not a single case of plague occurred among those who had crossed the road, proving convincingly the efficacy of disinfection.

21,255. How did you disinfect the cocks and hens?—I think I may say that that is a joke of the late General Duncan. I believe it is a fact that they were dipped into the perchloride of mercury solution before crossing the road, but I am not sure that I directed that extreme measure.

21,256. Did you disinfect the clothing?—Every single article that these people possessed was dipped.

21,257. The result was that you had no plague?—The result was that there was not a single case of plague across the road, except two children I found ill in a family on the right hand side of the road. We left them there, and they developed into plague in a day or two. There was also one case of a man who was left on watch in the Transport lines. He was the only man left in the lines. A few days after this health camp had been carried out, this man died of plague in the lines. I think that shows that infection was still rife in that ground, and did not travel across the road with the people who had been disinfected.

21,258. Plague went on in the cantonment?—Yes.

21,259. What measures did you take in the cantonment?—On the 17th of November the Plague Committee, as established by the Government of Bombay, commenced actual work. On the 27th of November, a Plague Committee was formed by a Government order, but we commenced work on the 17th November. At that time there was a great deal of confusion. People on plague duty were overworked. According to our views, and according to General Duncan's opinion, all was not being done that could be done, chiefly owing to the men on plague duty being overworked. On the 17th of November, arrangements were made for a more efficient manner of dealing with it, or, at all events, a more complete method of dealing with it. Major Ross was placed in chief executive charge. Plague at that time was so diffused throughout the cantonment that it was exceeding difficult to grapple with it, and, after careful consideration, it was decided to completely surround the enemy, and attack him simultaneously from all quarters. With this in view, the cantonment was divided into three divisions, each under a British officer, and each division was divided into a number of sub-divisions, in all 17, each under a supervisor, who was either a Native gentleman or a pensioned Native officer. Each supervisor had to prepare a list of all the inhabitants in his sub-division, with the object of keeping a check on arrivals and departures, and by this means to facilitate the segregation of the persons arriving from infected areas. Each subdivision had a search party, varying in numbers according to the density of the population in the particular area they had to search. Each division had a depôt or head-quarters, where the divisional establishments were located during work hours, and the depôts were as follows:—

No. I. Division—Nusserwanjee Petit Hall, Bhawani Pet Road.

No. II. Division—Charitable Dispensary, Connaught Market.

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No. III. Division—Camp, Brigade Parade Ground.

The divisional establishment was common to all the sub-divisions of each division, and consisted of:—

Medical official.
Ambulance party.
Disinfecting party.
Whitewashing party.
Segregation party.
Four ambulance carts.
Two disinfecting carts.
Two limewashing carts.
Two coolies carrying basins and bottles of disinfecting lotion, for the use of the search parties to disinfect their hands and clothing at once after handling a case.

No. I. and II. Divisions each had two lady searchers for visiting Muhammadans' houses where there were pardah ladies, and each lady was accompanied by a small escort of two soldiers. With this sub-divisional and divisional establishment nearly every house in Cantonments was searched daily. As cases were found by the different search parties, intimation was sent to the depôt. The Medical Officer went to diagnose the case; if pronounced plague, ambulance, disinfecting and segregation parties followed. The patient was removed to hospital, with one member of the family as an attendant, the remainder of the family or household were taken to the depôt for segregation. The effects were removed from the house, either left with the neighbours, sent to a store kept for that purpose, or taken with the family at their own discretion, and the house was disinfected and closed. Whitewashing was carried out the following day. All persons collected for segregation during work hours were taken in batches at the completion of the searching of each Division to the segregation camp. Where dead bodies were found two soldiers were left in charge of the funeral rites. As far as possible, members of the household only were allowed to handle the body, the remainder being kept at a distance. The soldiers accompanied the party, and as soon as the body was disposed of, the members of the household were taken straight to the segregation camp by one soldier, and the remainder of the party who assisted at the funeral rites were taken to the nearest disinfecting depôt by the other soldier, they and their clothing were disinfected and they were released.

21,260. Did you find much difficulty with regard to corpse inspection?—None whatever.

21,261. Corpse inspection was done before the body was moved?—Yes.

21,262. Did you find much difficulty among Muhammadan women?—None whatever. I have never heard of a complaint of any kind. Had there been any complaints I should have been sure to hear of them; but, as a matter of fact, I never heard of a single complaint. There are not very many Muhammadans living in the cantonment, but there is one lane which is certainly full of them. In any case there was a lady doctor available to visit Muhammadan women, if necessary.

21,263. What have you to say with regard to hospitals?—From motives of economy, the General Plague Hospital, and all private hospitals, consisting of four, Parsee, Muhammadan, Hindu, and Marwari, were all common to Poona City, Suburban Municipality, and cantonment. With the exception of the Parsee Hospital, they were outside Cantonment limits, and were entirely managed by the City Plague Committee, the cantonment bearing a share of the General Plague Hospital expenses.

21,264. I believe you issue death certificates?—Yes. There was reason to believe that the existing practice of accepting death certificates from other than Commissioned Medical Officers led to the concealment of plague in some instances, consequently orders were issued by the Plague Committee that death certificates from all causes other than plague would only be accepted from a Commissioned Medical Officer, and arrangements were made for a Medical Officer to be available at fixed hours, morning and evening, to view all dead bodies and to grant the certificate free of charge.

21,265. Did you evacuate the houses in which there was a plague case?—Every house in which a plague case occurred was evacuated completely.

21,266. For how long?—For 10 days.

21,267. Were the people placed in health camps?—When a case occurred people were placed in the segregation camp; the whole inhabitants of the house.

21,268. Were they allowed to go back to their work?—No, they were confined to the camp.

21,269. Do you think you got all the people to go into the segregation camp?—I should not like to answer positively with regard to that. I know we took an immense amount of trouble to get them all. I think we got very nearly all the people in Poona cantonment; but then you must remember that we had an enormous staff, both of Natives and Europeans, and European soldiers and Native soldiers.

21,270. What percentage of people do you think escaped?—I could not give the numbers.

21,271. In your opinion, would it be 5 per cent., or 20 per cent., or what?—Nearer 5 than 20 per cent.

21,272. I believe the people were made to take a bath in a solution of carbolic acid, 1 in 40, on entering camp?—Yes.

21,273. Do you think the people found that very painful?—That was modified, and phenyle was used afterwards on some occasions. I do not think that a bath in a solution of 1 in 40, made up with soft soap, is painful. I have often had my hands in a solution of 1 in 20 for a considerable number of hours a day.

21,274. I should think that to the scrotum, for instance, it might be?—There was never any objection made. Hundreds passed through the tubs.

21,275. Did the people go voluntarily into the health camps?—Not quite voluntarily. Major Ross and myself decided, on one occasion, to evacuate a certain block, it being riddled with plague cases. We went down in the morning and said to the people, "Now you have to go out." We got carts for them, and any number of soldiers to help them. They went out very quietly and happily, especially after they had seen some blocks evacuated. Towards the end of the epidemic they had their things ready, and were out in two or three hours.

21,276. You never evacuated a whole town?—Not at the same time.

21,277. Could you tell us how many deaths you had in the segregation camp?—No.

21,278. Could you tell us the number of cases?—No; I do not think they have been recorded. I have tried to obtain the information.

21,279. Can you give us the number of deaths in the health camps?—No. I can absolutely state, however, the number of cases of plague.

21,280. There was only one?—One absolutely; nominally there were one or two others.

21,281. Did you have a roll-call in the health camps?—Yes, at nine o'clock at night.

21,282. Did you find that all the people turned up, or did a certain number of them escape?—A certain number of them escaped.

21,283. How many?—A small proportion. The people were punished; it was not worth while to be absent.

21,284. How do you know that people actually answered to their names; might not someone else have answered for them?—We had a Native officer and two corporals—sepoys,—and three or four men. The Jamadar called the roll. Each corporal had his division and each man had his sub-division. They soon knew the number of people in each hut.

21,285. I believe when the Wanauri bazar people were sent to the health camp, a small row of huts was overlooked?—Yes. When the bazar people were sent to the health camp a small row of huts was overlooked, and the inmates left undisturbed. Amongst these people five cases occurred and three terminated fatally within 24 hours. The remainder were then segregated without delay. This object lesson proved of great value, and was not forgotten by the people.

21,286. Were you able to turn out the people in Wanauri village?—We had not room in the health camp, and about 1,500 Wanauri villagers practically remained unattended to until January.

21,287. And plague went on?—Yes; plague went on and on in that village until the people themselves fled to their fields. They brought plague with them into the fields, and cases continued. Our search parties used to visit the huts in the fields, and all the cases which are shown as cantonment cases in January are

practically from the fields of Wanauri and Wanauri village.

21,288. I suppose there was no disinfection?—No. The people left their houses, flying into the fields. It was with considerable difficulty that we could find the cases. They were scattered over miles.

21,289. How did you disinfect the houses in the cantonment?—Every house in which a case occurred had the roof or a portion of it removed. First of all the interior of the house, the floors, the walls, and dusty corners were lightly sprayed with a solution of perchloride of mercury. Every moveable thing inside the house was removed. All the people's clothing which had been left behind (the people having gone to the segregation camp) was disinfected with perchloride of mercury solution. All the collections of rags and rubbish, and all odds and ends which were valueless (and which collect to an enormous extent in some of these native houses) were brought into the street and burnt. During the earlier part of the epidemic we took up the floors; but we very soon abandoned that as unnecessary. Then the whole of the interior of the house was sopped with perchloride of mercury solution, until the floor was a bog. This was all done under the supervision of a British soldier. Practically every house in the bazar was done under the supervision of a British officer. Every house was seen wet by a British officer. As soon as it had dried it was whitewashed. The latrines were most carefully attended to; in fact, not a detail that one could think of was left undone.

21,290. Did you demolish any house?—Yes, we demolished a considerable number of houses.

21,291. How many?—The details are given in Appendix "B" of my "Report on Plague in Poona" and Kirkee Cantonments and Suburban Limits, from "17th March 1897 to 19th March 1898."* They may be summarised as follows:—70 houses were demolished or pulled down to be rebuilt, and one house was improved by the provision of windows for ventilation. This cost Rs. 5537 in payments of compensation money.

21,292. Have you anything to say with regard to the manner in which insanitary houses are formed?—Yes. It may be of interest to describe the process by which these houses get into this insanitary state, a procedure that can be seen in full operation in any regimental or Sadr Bazar, but which has now received a severe check in this cantonment. The operations are as follows: A row of houses consisting of single or double rooms is sanctioned with a broad street between the rows. The inhabitants first proceed to make a small enclosure in front of their houses, marked by a row of stones; the stones are succeeded by a low mud wall; then a few sheets of tin forming a verandah are put up partly resting on the mud wall and partly on a few sticks; the wall rises in height and the sheets of tin increase in number from year to year; then a few tiles and rafters are put up and before many years go by there is a room or, if the owner is more enterprising than his neighbours, even rooms both front and back; though it is true the door-way is not more than 4 feet high and the inner rooms are quite dark, but these are not considered drawbacks by the inmates.

21,293. I believe you had some plague among European troops?—Yes. Two cases occurred in soldiers of the Royal Irish Rifles employed on plague duty in the city, one on the 20th and one on the 29th of January, both patients were in hospital at the time plague was diagnosed, suffering from venereal disease, admittedly contracted while on their rounds in the city. On the 4th November 1897 a woman, the wife of a sergeant living in the Wanauri Barracks, was attacked. She had recently been shopping in the Sadr Bazar. All three cases ran a very similar course ending in recovery after a prolonged convalescence. In the cases of the two men the bacillus was searched for and it was recognised in one. All three patients had buboes in the groin, which suppurated. One of these men had been inoculated in April; in fact, he had been inoculated twice with Haffkine's serum. He got plague in January. The other had not been inoculated. About 50 men had been inoculated and 1,900 men had not been inoculated. One of the 50 inoculated men got plague, and one of the 1,900 inoculated got plague.

21,294. (*Prof. Wright.*) How long after inoculation?—The inoculation was performed in April, and he got plague in January—10 months.

* Not reprinted with the Proceedings of the Commission.

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21,295. (*Dr. Ruffer.*) I believe a certain number of squirrels died of plague, did they not?—Yes. In December 1897, when plague was very bad, I noticed squirrels crawling along the road, and not able to go up the trees. Then I heard some people saying that they saw three squirrels drop off the trees dead. After that I could at any time find the corpse of a squirrel about here if I looked for one.

21,296. Have you any evidence to show that these squirrels died of plague?—No.

21,297. I believe a grey squirrel in a cage died in the house of a European woman?—The wife of a sergeant who was attacked in November had a pet grey squirrel in a cage in her room, and it died suddenly the second day of her illness, when she was going to the hospital.

21,298. You have no evidence to show that that squirrel died of plague?—None whatever. I was too busy at that time to make any experiments.

21,299. What measures did you take to prevent re-infection?—By the middle of December the epidemic in cantonments was considered checked, and the following measures were adopted to prevent re-infection:—

1. A corpse inspection by a Medical Officer in every case of death.
2. Every case of sickness in the native population to be at once reported by the head of the house to the Supervisor of the district, by whom it was at once brought to the notice of the Medical Officer on plague duty, who, with the least possible delay, saw the case and determined the nature of the complaint. Both these measures worked wonderfully well and smoothly, the people knew and trusted their medical man.
3. Every arrival from outside the station had to spend 10 days in the health camp before being permitted to take up his residence in the bazar; but this rule was modified to suit many emergencies.
4. The normal population of the Sadr Bazar is probably 25,000, but by the end of November there were not more than 12,000 people in it at the utmost. All unoccupied houses were securely closed and sealed under the orders of the Cantonment Magistrate. No house was re-occupied until it had been well cleaned in the fullest sense of the word, disinfected and limewashed.
5. Surprise night visits were made by the troops on plague duty under their officers, and it was remarkable how few breaches of the regulations numbered 2, 3, and 4 were brought to light, and when a few delinquents had been punished the necessity for the night visits ceased. The people had learnt to trust in the plague measures, and to a great extent co-operated in them.
6. Under the Poona City Plague Committee a strict surveillance of all arrivals by rail was arranged for, those coming to cantonments were sent to the health camp, and if they came from an infected locality obliged to sleep there for 10 nights. Many modifications and relaxations of this rule were from time to time introduced but detailed description does not come within the scope of the present statement.
7. On the 16th January a sanitary cordon of cavalry was established around the city, cantonments, and suburban limits to deflect the traffic on to the main roads, where observation posts were established, supplied with disinfectants, and small camps were erected in which the people wishing to enter were detained till they were seen by a Medical Officer.

It may be noted that, as far as can be gathered, but six cases of sickness were sent during the whole time from the posts to the Plague Hospital.

21,300. Will you give us the orders for the cordon?—They were as follows:—

1. From 6.30 a.m. till 6.30 p.m. no carts, pack animals, or coolies carrying other than articles of merchandise will be allowed to pass through the cordon *except* by one of the authorised roads where there is a post.
2. Agricultural labourers, coolies carrying articles of produce for sale, persons in charge of cattle, and all persons without other effects than what they are actually wearing will be allowed to pass at all points.
3. The object of the cordon is to insure that all persons and families who have been living outside Poona will, with their effects, be properly

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disinfected before being allowed to return to reside in their houses in Poona. The question of their disinfection and retention at the several posts does not concern the cordon, it will lie with those in charge of the posts, and the men employed on cordon duty are simply to insure that all such persons and families pass by the posts and not by other roads.

4. From 6.30 p.m. till 6.30 a.m. all carts, pack animals, or coolies carrying articles such as household goods and wearing apparel will be stopped outside the cordon and not allowed to pass. But all empty carts, unladen animals, night-soil carts, rubbish carts, and carts or animals carrying grain, produce, and articles of merchandise only, will be allowed to pass freely.

21,301. What were the orders for posts?—They were as follows:—

1. A cordon has been placed round Poona for the purpose of stopping the importation of plague by persons returning to reside there from infected areas.
2. Posts have been established at all the main approaches to Poona, and the duties of the cordon are simply to make all such persons pass by the Posts and not by other roads, and to stop their passing at all during the night when the work at the Posts must of necessity cease.
3. The N.C.O. in charge of each Post will arrange for the inspection of all traffic that passes and will work as follows:—

(I.) All carts, animals, or persons carrying only articles of merchandise will be allowed to pass without detention.

(II.) All empty carts, night-soil and rubbish carts, unladen animals, and persons carrying nothing but their wearing apparel, will be allowed to pass without detention.

(III.) All carts, animals, and persons conveying articles of household use, bedding, clothing, &c., will be stopped either passing in or out.

(*a.*) All those passing out will have their persons and effects disinfected, and they will be allowed to proceed.

(*b.*) Those passing in will be disinfected and detained till an Officer on plague duty decides what is to become of them.

(IV.) Europeans in Government employ will, with their servants and belongings, be allowed to pass at all times.

(V.) All persons showing signs of sickness will be sent or detained for medical inspection.

(VI.) Persons arriving at a Cantonment Post, who propose to reside in the city, will not be disinfected in cantonments, but will be passed under escort to the City Segregation Camp, Parvatti Road, with a note of their numbers. Persons arriving at a City Post, who propose to reside in cantonments or Suburban Municipality, will be similarly passed under escort to Cantonment Health Camp, Shunkerset Road.

21,302. What are the Sanitary Orders for Troops on Plague Duty?—They were as follows:—

1. They are to live in camp.
2. Sober men only are to be chosen.
3. The working parties are to be inspected by a Medical Officer daily before they move off; those with any sign of fever or debility to be struck off duty.
4. Abrasions on the hands or face are to be specially looked for; the men may grow beards.
5. A good breakfast is to be supplied before work begins.
6. Arrangements should be made to supply a midday meal in cases where the men cannot return to camp in time for their dinner.
7. Patties should be worn to prevent the dust from infected houses coming in contact with the legs.
8. It should be impressed on the men that a fruitful mode of infection is through abrasions on the skin, and all such should be reported at once to the Medical Officer.
9. A supply of carbolic lotion, 1 in 40, is to be sent with each party, and in the interval of work the hands should be swilled with it.
10. The parties should be warned not to commence thorough cleaning until some preliminary disinfection of an infected house has been carried out.
11. Disinfectants should be freely used in camps.
12. Immediately on return to camp from plague duty the whole of each man's clothes will be changed, and the suit taken off and hung in the sun, then each man will take a bath with phenyle in it; carbolic soap will be liberally supplied.

21,303. I believe there was also some plague in the suburban part of the town?—Yes. That was in a tongue of land between the city and Poona cantonment and Kirki. It also contains the Poona railway station. For a long time every case found in the railway station was shown as an imported case of plague in the Suburban Municipality.

21,304. Did you take the same measures?—Practically the same measures.

21,305. In your report* on plague in Poona and Kirki cantonments and suburban limits, you give some medical notes on the late epidemic, and you say, "The "perchloride of mercury used must be the English "salt. A native-made salt, supposed to be perchloride. "has, I know, been used, but it is worse than useless, "as it consists of more than 50 per cent. of calomel, "as well as some sulphate of mercury, and clay." Have you had this native salt analysed?—Treacher and Co. told me that they had analysed it, and had found that it consisted chiefly of calomel, and something which they believed to be sulphate of mercury and clay.

21,306. In your experience has English salt been used, as a rule, or native salt?—When I came here native salt was the only thing used.

21,307. Native salt is very much cheaper, is it not?—Yes. It was impossible to make the solution with it. It was issued in packets, and each packet is supposed to be sufficient to form a bucketful of solution of 1 in 1,000. I examined some of the packets. The weight, I think, should have been 184 grains; but the weight of these packets varied from rather less than ½*d.* to 2*d.* It was impossible to make more than from 30 to 50 per cent. of any single packet dissolve in water.

21,308. Can you tell us how much clay the perchloride of mercury contains?—I do not know. There were impurities.

21,309. There must have been a considerable quantity of impurity if only 50 per cent. dissolved?—You could not make 50 per cent. of native salt dissolve with any amount of sodium chloride.

21,310. So that your 1 in 1,000 only contained 2 per cent.?—It is something very small. Even by the addition of acid you could not make more than 50 per cent. of the native salt dissolve.

21,311. Do you think that the native habit of sleeping on the floor has anything to do with their getting plague?—I think so. It is, however, merely a matter of opinion, and not of fact.

21,312. (*Mr. Hewett.*) The habit of sleeping on the floor is more prevalent in this part of India, than in Northern India, is it not?—Yes. Charpoys are very generally used in the north of India, and I think that may have an influence in causing a plague epidemic to be more easily controlled in Northern India than in Southern India.

21,313. In your Report* you say that the total number of cases in Kirki was 690. What was the population among which these cases occurred?—3,700.

21,314. In Poona cantonment there were 422 cases among a population of 12,000?—At that time the population had probably sunk to 12,000.

21,315. The number of deaths at Kirki was 561?—Yes.

21,316. And in Poona cantonment 293?—Yes.

21,317. Was there anything particular in the character of the population of these places which made your task easier than it might have been in other parts?—I think so. The people were well acquainted with the habits of Europeans. They were people whose livelihood depended upon the Europeans living in Poona. They were not afraid of Europeans; they had been accustomed to them all their lives. This, undoubtedly, made our task much easier.

* *See above.* Not reprinted with the Proceedings of the Commission.

21,318. Do you consider that even passive opposition on the part of the people would have made your task much harder?—No one could hope to control an epidemic unless the population were on his side.

21,319. (*Prof. Wright.*) Did you find any objection to disinfection, did the people try and conceal their best clothes or bribe the disinfectors?—I think it is hardly possible. I have known a bribe offered to British soldiers, but it was quite useless. The people had much better submit; and they did submit. I do not think there was any concealment. At the first the lady of the house would do her utmost to conceal her best belongings, and carry them away through the back door, as soon as she knew a search party was coming. Very little could be done with success, however, in that direction. We had such an enormous body of people helping us that the back door was as carefully guarded as the front door. There was no escape.

21,320. (*The President.*) Do you endorse the opinion of Major Ross, which you have quoted in your Report* ?—Yes. Major Ross writes:—"The effect of health-"camping was almost magical: of 4,000 people taken "from the worst infected areas, only one undoubted "plague case occurred after they had returned to "their houses: in that instance the woman who was "attacked was only six days in camp, and was taken "ill the evening of the day she left." I believe that firmly; in fact, I can go further and say that the total numbers were 6,100, and that was the only undoubted plague case that occurred after the return of those 6,100 people from the health camps.

21,321. You endorse it from your own observation?—Entirely.

21,322. What do you mean when you state, in your Report,* "On the other hand, no disease is so easily "combatted by the resources of the modern sanitary "science"?—In my experience, the measures which were successful in removing plague from Poona cantonment were those which, if applied to an epidemic of scarlet fever or diphtheria at home, would not produce the same results. Plague, in my idea, is a purely local, narrow disease, and is easily dealt with. Its means of spreading are so local and few that it is perfectly possible, by following out the ordinary sanitary rules, which would be applied in every epidemic, to obtain a much more successful result than when dealing with an epidemic of any other infectious disease. Nothing but these facts would justify the amount of money we have spent on plague; a similar expense in an epidemic like scarlet fever in England, or here, would be waste of money, because the results would not be commensurate. I hold that the results have justified the expenditure. I may also say that I have heard it said that the measures were taken on a falling epidemic, and were therefore successful. But I must say that these measures in our instance, neither in Poona cantonment, nor in Poona city, were adopted on a falling epidemic. The epidemic increased, or certainly held its own for the first weeks afterwards. It rose for two or three weeks before we commenced our measures. We commenced our measures in Poona cantonment on the 17th of November, but it was not until the beginning of December that efficient measures were adopted in Poona city; yet the epidemic continued as virulent in Poona city as it had been, while it was declining in Poona cantonment.

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21,323. Do you still adhere to the opinion you have expressed in your précis that "It is unfortunately an "axiom that plague in its epidemic form is only to be "found where dirt, darkness, and overcrowding pre-"vail; in a word, in those places where sanitation is "unknown, impossible, or neglected. Most fortu-"nately, it cannot be carried to any appreciable "extent by water or air, and the bacillus which causes "it, though capable of multiplication with extra-"ordinary rapidity in a suitable midus, has neither "power of resistance, locomotion, or spore formation, "had dies at once in the light of day"? Does that entirely represent your present views?—Yes; I hold by every word of that.

21,324. On the last page of your précis you express certain views with regard to inoculation. I suppose those views are based partly on your own observation?—Yes. Observation and reflection, I think, enable me to draw the conclusion that it would need to be universal in order to be successful.

21,325. Will you read what you say?—That is what I say:—"I feel that I have not sufficient experience "to add anything to the knowledge of inoculation and "its uses; but I may be permitted to say that it "appears quite clear that if inoculation is generally "adopted, in supersession of the ordinary sanitary "regulations, as a measure for the suppression of "plague, it should be universal, which is obviously "impossible; because, if any minority in an infected "city remains uninoculated their doom is sealed, they "must be practically exterminated. A little reflection "will prove this, while the inoculated are, in a great "measure, protected for a limited time, and are "thereby given a feeling of security, their houses, "clothing, bedding, etc., continue to hold and carry "the seeds of the disease, and will undoubtedly dis-"seminate it far and wide, to the utter destruction of "the uninoculated minority."

21,326. From as full a consideration of the subject as you have been able to give, you still endorse those opinions?—Those are the conclusions I have arrived at. It is true that they are not absolutely mathematically correct, but they are conclusions one arrives at from experience and reflection upon the subject.

21,327. (*Dr. Ruffer.*) You say in your précis, "The "sanitary cordon as adopted round the city and can-"tonment in January 1898 appeared necessary at the "time, but it can now be shown that it was not really "required." Kindly tell us upon what you base that statement?—I am afraid it would be very difficult to show that absolutely. I am prepared now to think that it was not really required at the time.

21,328. Why?—Because, after we had put it on, we came to examine carefully into the working of the cordon, and we found, especially at night, that it was perfectly easy to get through. Internal quarantine, as I said at the time it was put on, can never be effective. Anyone who chose to get through it, especially at night, could do so with greatest facility. One could take a horse, or a carriage and four, through it if one wished. There is not the least difficulty.

* *See above*; not reprinted with the Proceedings of the Commission.

(Witness withdrew.)

Mr. H. C. Venis called and examined.

Mr. H. C. Venis.

21,329. (*The President.*) You have had experience of plague duty in Poona?—Yes.

21,330. Have you an official position here?—I was sent out by the Secretary of State for India.

21,331. Will you mention your medical qualifications?—L.R.C.P., L.R.C.S. Edin.

21,332. (*Prof. Wright.*) What duties do you perform at present in Poona?—My duties include a variety of things—my chief duties are corpse inspection and examination of the sick.

21,333. Is every case of sickness notified to you?—Yes. Cases of illness in the city are reported by the friends of the patient, or by the volunteers either to the Medical Officer on duty at the Central Plague Office, or to the Cheif Volunteer at the Ward Office of the division in which the patient lives. The Chief Volunteer then forwards the report of the sick to the Medical Officer.

21,334. Do you look after one ward or one division of the town?—No, we (*i.e.*, my colleague and I) are the Medical Officers of the whole city.

21,335. Do these notifications of sickness come in?—Yes, either by the friends of the patients directly to the Medical Officer at the Central Office, or through the agency of the volunteers.

21,336. Do the Medical Officers attend all through the 24 hours?—They attend for 12 hours from seven in the morning till seven in the evening.

21,337. No Medical Officer attends during the night?—No.

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21,338. Notifications of the sick all come in during the day?—Yes.

21,339. When they come in do you go immediately to see the sick person?—Yes, but if there are some corpses to be examined, the sick are taken after the examination of the corpses, or on the way there; it all depends upon circumstances.

21,340. Is there opposition to your examining the sick?—During my 15 months' experience I have had only about two or three cases in which the friends of the sick person objected to medical examination.

21,341. Is every case of sickness reported to you, such as a case of diarrhœa?—Yes, all cases of sickness.

21,342. Even mild attacks of fever?—Yes.

21,343. And headaches? I want to know whether the cases of sickness which are reported are only grave cases?—No, not only the grave cases. I had a case of deafness reported to me yesterday morning.

21,344. There are comparatively slight cases among these returns?—Yes.

21,345. Then you go round and see them?—Yes.

21,346. What examinations do you make of them? Do you content yourself with determining whether they have plague, or do you examine them to see what is the matter?—Up to last February, when plague was rife, we did not diagnose beyond seeing whether a case was plague or not, but after that time, when the epidemic died away, we arrived at an approximate diagnosis in each case.

21,347. And that is your practice at present?—Yes.

No.

MEDICAL CERTIFICATE.

Name _____

Age _____

House No. _____ Peth.

Certified that I have examined this person and that is not suffering from Plague but from

Special Plague Medical Officer,
Hd. Qrs. Segregation Office,
315, Shukrawar Peth.

Date ____ 189

The left-hand side is kept by us, and the right-hand half is given to the patient.

21,348. Did you find many of these patients had been sick for a number of days before you were called in?—Some of them.

21,349. What are the regulations—that they shall report one day's illness to you?—No. Parties of volunteers go round in each division of the district. They notice the sick people in their homes and report.

21,350. Do the volunteers go into the houses?—Yes, native gentlemen, who have volunteered to report cases of illness.

21,351. What is their work? Do they go into houses and force an entrance, or are they allowed to go in voluntarily?—They are allowed to go in voluntarily. They ask at the doors if anyone is sick.

21,352. Does most of the information come to you by means of the volunteers, or is it notified by the relatives?—About half and half. The people voluntarily report cases of sickness now.

21,353. When these deaths are notified to you, do you find that a large percentage of them had been notified to you previously as sick cases?—Yes.

21,354. What is the percentage?—From the 25th January to the 31st December 1898 I examined 1,809 sick people, and of those 601 died.

21,355. Every corpse had been previously seen by you during life?—Yes, *i.e.*, every corpse included in the number (601) mentioned above, which is the number of those people who, previous to death, had been examined and certified by the Medical Officers. This is the form of certificate:—

No.

MEDICAL CERTIFICATE.

Name _____

Age _____

House No. _____ Peth.

Certified that I have examined this person and that is not suffering from Plague but from

Special Plague Medical Officer,
Hd. Qrs. Segregation Office,
315, Shukrawar Peth.

Date _____ 189

21,356. When you examine corpses do you issue another form of certificate?—Yes, I should rather call it a pass, a cremation or burial pass.

21,357. What examination of the corpses do you make to determine whether the person has had plague or not? Have you got that certificate with you when you go to see the corpse?—In many cases.

21,358. You examine the certificate which the patient had during life?—Yes; because we find it (*i.e.*, the left-hand duplicate of it) in the Medical Officer's Office.

21,359. If that says that the patient died of plague or was ill of plague you take no further steps?—That is so.

21,360. You make a fresh examination?—Yes, many of those certificates have been issued six or seven months before.

21,361. The patient had been sick six or seven months?—Yes.

21,362. Then you make a fresh examination of the corpse; what do you examine for?—Specially for buboes and glandular swellings of any sort.

21,363. Are there any other signs of plague which you can detect in a corpse?—The general appearance and the previous clinical history.

21,364. What is there in the general appearance which would put you on the track?—The last few cases which we have had in Poona City have been of the septicæmic type of plague.

21,365. How do you determine those to be cases of plague?—There is a peculiar facial expression about the corpse; the features are contracted, and there is a sort of anxious expression which the deceased had before death, and the eyes are fixed and glistening. The whole countenance has a worn expression, as it were; the cheeks are sunk in, and the tongue, in the majority of cases, exhibits a thick white fur, and in a few of the septicæmic cases, a black fur. By the time the Medical Officers arrive, if many hours have not elapsed, the body is distinctly warm. There are no buboes in those cases.

21,366. Do you find a plague corpse keeps warm longer than that of a person who has not died of plague?—Yes, it is a continuation of the increased temperature.

21,367. How soon after death is the corpse examined?—In some cases within half-an-hour or an hour, but if I am out on my rounds and the death is reported, it may be two hours before the corpse is examined.

21,368. A patient who dies after seven in the evening is not examined till the next morning?—That *is* so.

21,369. Is there trouble with the relatives?—We have had two or three complaints.

21,370. What are the complaints, that the laying out of the patient has been delayed?—Yes.

21,371. Have you any other complaints but that?—None that have been brought to my notice.

21,372. Do they object to your examining the bodies of females?—Not of females particularly. I have had two cases of objection which I have called case A and case B in my précis of evidence.

21,373. Perhaps you will tell us what the objections were founded on?—The first case was that of an ascetic, a holy man, a Fakir, I had seen this patient myself, and he was suffering from dysentery. He had also been under treatment at the Sassoon General Hospital, from which institution he got the certificate. When I saw his corpse about five days after my first visit, I had no need to examine the corpse because I myself had seen. His friends produced a certificate which I had given him (the right hand duplicate), and they also produced a certificate from the Surgeon of the hospital. There was no swelling, and the cause of death was quite plain. In another case an objection was raised on the ground of the patient's caste. He was a Brahman, and they asked through the Chief Plague Authority if a Brahman medical man might examine the corpse for buboes in the presence of a Medical Officer. This condition was readily granted, and the native medical man examined the body in my presence. I was as close as possible, and satisfied myself there were no buboes.

21,374. Those are the only cases?—Those are the only two cases in my experience lasting 15 months.

21,375. You have examined all the female corpses just the same?—Yes. My colleague, Dr. Betenson, had an objection raised when he was examining a female corpse, but that has not occurred in my experience.

21,376. How many cases of plague have you detected by corpse inspection?—106 cases of plague out of a total of 3,035 corpses examined.

21,377. How many of those cases were detected as plague cases during the corpse inspection which had been recognised to be plague when they were previously visited?—I cannot answer that question because when a case is diagnosed as plague it is sent off to the Plague Hospital or the observation ward, and they die there.

21,378. These are all cases which were not recognised as plague in the sick visitation?—Yes.

21,379. You think the visitation of the sick by itself would not suffice, because these 106 people slipped through your hands during the sick visitation?—Yes. (Witness, in correcting proof of his evidence, added a note correcting his statement as follows:—None of these 106 cases of plague were seen during life, and they were seen for the first time as corpses.)

21,380. How many plague cases did you discover when you visited the sick?—The total number of cases of illness in Poona City examined during life and certified by the Special Plague Medical Officers from the 25th January 1898, to the 31st of December 1898 was 1,891, and of these cases 601 resulted fatally. From March up to about the end of December, by means of our sick examination system, we discovered 25 or 26 cases of plague which were sent to the Plague Hospital or to the observation ward. Before that I had no figures.

21,381. Out of every five cases of plague discovered by means of sick visitation and corpse inspection, was only one discovered by sick visitation and four by corpse inspection?—Yes.

21,382. You think that of these two measures corpse inspection is by far the most useful?—It is very valuable.

21,383. Do you think the sick visitation might be omitted?—No, I do not think so, because that is a very useful mode of procedure too in helping us to detect cases of plague in the early stages.

21,384. What advantage do you think you get from that:—the lessening of the spread of inspection?—Yes, certainly, because as soon as a case is seen and diagnosed to be plague, arrangements are made for the removal or treatment of the patient, and thereby the further spread of the disease is prevented.

21,385. In your whole year's work you only found out 25 cases by your sick visitation?—Yes; they were seen and removed within a very short time.

21,386. Were these cases which you took out moribund or in the early stages of plague?—In the early stages, many of them.

21,387. If they had been moribund, I presume you would have got them a few hours afterwards as corpses?—Yes.

21,388. Do you know how long they had been sick, or were the facts you go not sufficiently trustworthy?—We have notes of all these cases which will be produced by the Chief Plague Authority.

21,389. Have you any other duties in connexion with plague besides sick visitation and corpse inspection?—Yes; I had medical charge of three camps—the railway detention camp, the segregation camp, and the Bhamburda health camp.

21,390. Are there any statistics available to tell us what the percentage of attacks was in the segregation camp?—Yes, I will supply those.

21,391. Can you compare those with the incidence of plague in the town? Can you tell us whether the percentage of attacks among the contacts was greater than the percentage of attacks in the town?—Yes. (The following statement was supplied later by the witness:—

Week ending.	Segregation Camp.			City.	
	Cases.	Admissions.	Percentage.	Cases.	Percentage.
8th October -	3	420	·710	114	·190
15th „ -	3	169	1·775	180	·300
22nd „ -	3	218	1·376	242	·403
29th „ -	6	324	1·851	347	·578
5th November	6	556	1·079	396	·660
12th „ -	5	986	·507	316	·526
19th „ -	3	850	·352	413	·688
26th „ -	9	971	·926	382	·636
3rd December	4	527	·759	376	·626
10th „ -	3	502	·597	424	·740
17th „ -	2	539	·371	334	·556
24th „ -	2	717	·278	211	·351
31st „ -	2	391	·511	155	·259

The percentages of attacks are taken week by week, from 2nd of October to the 31st December 1897, this being the period during which the epidemic was at its height. The comparison with the percentage in the City is not easy to obtain owing to the great exodus of people during the epidemic, and is taken for the same three months for 60,000 people. The total percentage is given below, the mean between the epidemic population and the normal being taken as a fair average of the population during the whole outbreak. The percentage for the City for the whole epidemic, taking the population at 90,000, is 5·16)

21,392. Have you done any disinfection work?—Lately I have been placed in charge of disinfection work.

21,393. What houses have you disinfected?—The Medical Officer, in the course of his rounds, makes a note of all the houses in which plague deaths have occurred, or plague sicknesses, and he reports those to the Central Office. There are two Superintendents for the city of Poona, and they take out disinfecting parties to disinfect those houses.

21,394. Who are those Superintendents?—Captain Lockhart Mure and Mr. Holland.

21,395. Are these officers directly in charge of the disinfecting parties?—Yes.

21,396. How many disinfecting parties go out in the day? Are there only two disinfecting gangs, each with with an officer?—There are so many men available at the present time for this disinfecting work, and those men are divided up. If the houses all happen to be in one direction in the division of one officer, he takes the whole party.

21,397. Is there a European officer sent out with every gang?—A Superintendent goes out with a party.

21,398. Does a European officer superintend the disinfection of every house?—Yes; the European officer being the Superintendent as well.

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21,399. Where are the disinfectants made up?—At the Municipal Technical School, where the disinfecting apparatus and materials are stored. The disinfectant used is an acid solution of perchloride of mercury.

21,400. Are those concentrated disinfectants?—Yes.

21,401. Do you know what strength they are?—1 in 725, that is what we are using at the present time.

21,402. That is not the solution sent out?—No; it is sent out in a strength of 1 in 100.

21,403. A 1 per cent. solution is sent out, and that is diluted?—Yes. A wooden corn measure is taken filled with the original solution; that is placed in a wooden bucket, and water is added from a pail to about four inches from the top. That makes a solution of 1 in 725. For the disinfection of clothes we use a strength of 1 in 1,000.

21,404. You dilute the solution 7·2 times?—Yes.

21,405. Why was this inconvenient measure taken?—It is convenient for us, because it is very easily obtained. Each disinfecting party takes the solution with them in small casks. We can easily get water in Poona, and the solution is made to this strength on the spot.

21,406. How is the disinfectant applied? Is it sprayed on?—We have pumps. Before the coolies are allowed to enter a room the floor is wetted with the solution. To protect the coolies, I may add, I was supplied with wooden sandals to protect their feet. Then the floor is scraped up, and the floor and walls are thoroughly disinfected.

21,407. Has everything been removed from the room before disinfection was undertaken?—Yes.

21,408. How are the articles which are removed disinfected?—With the solution.

21,409. Are they dipped into the solution?—Yes, at the discretion of the officer in charge of the party.

21,410. How is this discretion exercised?—The clothes are disinfected in the solution of 1 in 1,000.

21,411. Supposing they are clothes which would spoil with the solution, what is done? Is there an alternative measure?—We have compensation, and so on.

21,412. What is done with the metal vessels?—They would not be disinfected.

21,413. Are there a good number of articles which may escape disinfection?—Certainly.

21,414. Do you know whether any cases of plague have occurred in your disinfecting gangs?—No cases have been brought under my observation since I have been in charge.

21,415. Have disinfecting gangs been inoculated with Professor Haffkine's prophylactic?—No.

21,416. You have sent in a statement showing the statistics of corpse inspection, with a variety of diagnoses; do you put that statement in?—Yes. It gives the total number of corpses examined, together with the probable or approximate cause of death in each case. No *post-mortem* examinations are made, therefore the exact cause of death is not ascertainable. The statement is as follows:—

STATISTICS of CORPSE INSPECTION, POONA CITY, 1st January to 31st December 1898.

Probable Cause of Death.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total Deaths from each probable Disease.
Accidents	3	5	5	6	—	2	2	5	5	7	3	3	46
Alcohol	—	—	1	—	—	—	—	—	—	2	—	—	3
Asthma	1	9	10	—	—	—	—	—	—	—	—	—	20
Blood Diseases	—	1	1	2	2	—	3	2	2	3	5	5	26
Bronchitis	1	17	21	26	20	23	31	35	42	45	34	37	332
Broncho-Pneumonia	—	2	8	9	5	9	15	17	14	18	26	23	146
Brain and Nervous	1	—	3	1	1	5	2	5	1	8	9	3	39
Cholera	—	—	—	—	—	—	—	2	—	—	—	—	2
Colic	—	—	8	3	2	2	1	—	2	—	—	1	19
Convulsions	2	4	6	11	8	6	11	20	4	11	23	11	127
Croup	—	—	—	—	—	—	—	—	—	1	1	—	2
Debility	—	—	—	—	—	—	3	3	—	4	3	2	15
Dentition	—	—	—	2	—	—	—	—	—	—	—	2	4
Diarrhœa	6	14	17	37	46	47	80	127	85	74	42	55	630
Dysentery	1	4	6	2	3	3	2	2	3	8	13	6	55
Dropsy	—	4	6	1	2	6	5	5	6	2	4	10	51
Fevers	—	2	5	6	8	12	11	12	7	6	5	19	93
Goitre	—	—	—	—	1	—	—	—	—	—	—	—	1
Heart Disease	2	2	2	7	4	3	6	1	3	5	5	5	52
Hernia	—	—	1	—	—	—	—	—	1	—	—	1	3
Hydrophobia	—	—	—	1	—	1	—	—	1	3	1	—	7
Inanition	9	12	18	23	25	24	59	73	59	42	39	36	419
Leprosy	3	1	4	1	1	2	1	4	1	1	4	2	25
Liver	—	2	1	2	2	5	2	1	1	2	5	4	27
Malignant (cancer)	—	2	1	—	—	3	5	—	1	2	2	2	18
Measles	—	—	—	—	—	—	—	—	—	—	2	5	7
Opium-poisoning	—	1	—	—	1	2	—	—	—	—	—	—	4
Peritonitis	—	1	1	—	2	4	—	—	—	—	4	—	12
Plague	90	10	2	1	1	—	—	1	—	1	—	—	106
Pneumonia	—	1	3	4	6	1	—	6	5	4	7	4	41
Puerperal	1	1	—	2	3	1	4	1	5	4	3	6	31
Rheumatism	—	—	—	1	—	—	—	—	—	—	1	—	2
Rickets	—	—	2	3	2	4	—	—	—	—	2	—	13
Senile decay	23	9	8	14	9	9	11	6	14	10	22	20	155
Small-pox	—	1	1	—	—	1	—	1	—	—	—	—	4
Snake-bite	—	—	—	—	—	—	1	—	—	—	—	—	1
Spleen	—	—	—	—	—	—	—	—	—	1	—	—	1
Still-born	4	8	5	9	6	13	8	18	13	14	14	15	127
Sudden death	—	—	—	3	2	2	—	2	4	—	—	2	15
Syphilis	1	—	—	1	—	—	—	1	3	1	1	3	11
Tuberculosis and Phthisis	4	10	11	15	15	16	26	10	15	23	30	20	195
Unknown	63	3	13	—	—	—	—	—	—	—	—	13	92
Urinary	—	3	—	1	2	1	3	1	3	2	4	7	27
Whooping cough	—	—	—	—	1	1	3	1	—	3	13	10	32
Zenana Hospital	—	—	—	—	—	2	4	1	—	—	—	—	7
Total number of deaths per mensem	215	136	170	194	180	210	299	363	302	307	327	332	3,035

21,417. Are these diagnoses arrived at by corpse inspection?—Yes.

21,418. You have diagnoses, for instance, of snake bite and spleen; were those diagnoses made at the corpse inspection?—Yes, from the clinical history and from the mark of the snakebite, and so on.

21,419. Would you be able to make any of these diagnoses independently of the medical history which has come to you?—In many cases we can; we could see for ourselves.

21,420. Let us take these things one by one; could you see alcohol?—We had the history of the three cases of alcoholism mentioned in the table. They were examined and certified during life.

21,421. I am asking you, could you diagnose it independently of the history, because the history depends on the patient who may give you a wrong history?—We go by the history and the general aspect.

21,422. You do not profess that these diagnoses, such as alcohol, blood diseases, and bronchitis, are all derived from corpse inspection?—No, they are the approximate causes of death, arrived at by a general consideration of the facts of the case. All these diagnoses are found by corpse inspection *plus* previous examination of the deceased during life, because many of them were certified. The clinical history was gone into as fully as possible, and the approximate cause of death arrived at.

21,423. (*Mr. Cumine.*) What is the population of that part of the town in which you had the inspection of sick persons and corpses?—Not less than 130,000. We inspect the whole city.

21,424. Do you, personally?—I and my colleague personally.

21,425. What is the penalty for not reporting sickness?—There is no penalty—at the present time, that is to say.

21,426. What is the penalty for not reporting a death?—There is no penalty now.

21,427. Supposing a person is found to be dead at 7 in the morning, what means have you of knowing whether he was ill before 7 o'clock the previous evening? When plague is very virulent people are taken ill and die within 12 hours, do not they?—Yes.

21,428. When they are reported to be dead at 7 o'clock in the morning, what is the means that you have for knowing that they were or were not ill before 7 o'clock the previous evening?—The clinical history supplied by relatives and friends of the deceased.

21,429. Supposing they declared the man was not ill before death, or that he was taken ill after 7 o'clock in the evening, what means have you of knowing it is not true?—We have no direct means, but we reconcile the statement with the general appearance of the body.

21,430. What is the largest number of corpses you have ever had to inspect of people who have died during the 12 hours of night?—I have examined as many as 27 corpses in one day, and 18 in the morning, but I cannot tell you how many died in the previous 12 hours. Some of them I know died an hour before I arrived.

21,431. 18 is the largest number you have had to examine in one morning?—Yes.

21,432. How long would it take you to examine 18 corpses?—These were not reported at the same time. They were in different parts of the city, and reports came to me up to 11·30 or 12 in the day.

21,433. So that the inspection of these corpses took you to 11.30 or 12 in the day?—Quite that.

21,434. If somebody died at 5 minutes past 7 on Friday evening, his corpse might not be examined until 12 o'clock mid-day on Saturday?—That is not so, because that particular case would be reported the first thing in the morning by the friends of the deceased and that corpse would be seen first.

21,435. What is the maximum number of deaths which you have had reported to you at 7 o'clock in the morning as having occurred within the previous 12 hours?—I cannot tell you that. I do not think we have a means of knowing, because we do not keep the hours at which reports are made by the friends.

21,436. How long does it generally take you to get through the corpses of people who have died in the preceding 12 hours at night?—On the occasion I have mentioned, when I had 18 corpses, they were finished at about a quarter to 12.

21,437. It is possible, is it not, that a person might die at 7 o'clock in one evening and the corpse not be examined till 12 o'clock the next day?—If the cases were reported at 9 or 10 o'clock I would be on my rounds which would fully occupy 1½ hours, because the sick have to be examined, especially urgent cases of illness. When I come back, if there are four or five deaths reported, I start out again.

21,438. What is your answer then?—I say it is impossible to tell, because we do not notify the time at which death reports are received at the Medical Officer's office, but I should not think it is possible, because if a person died at 7 o'clock at night the friends would be anxious to give information the first thing in the morning, and then that corpse would be seen forthwith.

21,439. When you go to breakfast in the middle of the day, who is there present to do corpse inspection of any one who may die?—There is an interval of three hours.

21,440. Then you are not on duty ready to do corpse inspection from 7 in the morning till 7 in the evening?—The work is divided between the two Medical Officers from 7 a.m. to 7 p.m., with the exception of an interval at noon.

21,441. What is the interval in the middle of the day during which there is nobody on duty?—From 12 to 3.

21,442. Supposing that by 12 o'clock you had not finished an inspection of all the corpses of people who had died at night and in the morning, what would you do?—We would finish them.

21,443. Is it not the case that sometimes in bubonic plague the buboes subside before the man dies, or just after?—I have not met with an example.

21,444. In some cases, I think, the disease was not diagnosed as plague in the lifetime of the person, but was diagnosed as plague after death. In how many cases did that occur? Was it 106?—These 106 were cases diagnosed which had not been previously reported—they were the corpses seen.

21,445. They had not been seen in life at all?—That is so.

21,446. Were these people living in Poona or did they come from outside anywhere?—I take it they were residents of Poona.

21,447. How had they got the plague?—The month of January (when plague was very bad) was the second bad month. You will remember that in the last outbreak of plague for the week eneing 11th December there were 470 odd cases of plague. In January the cases were 90, in February 10, and in March two, and in April one. Then we had one imported case in June and one again in October, making a total of 106. Then, of the imported cases which occurred sporadically, there was one in August, one in October, and one discovered by the surveillance system. Of course, these 90 cases were not seen during life; we were at the height of the epidemic, which was of a virulent type.

21,448. Since July last has there been any case where the patient has been seen in life but the illness has not been diagnosed as plague, but has been diagnosed as plague after death on corpse inspection?—No, there has not been any such case, because they were diagnosed during life. They were found out during life through our system of reporting sickness.

21,449. (*Mr. Hewett.*) How many of the 106 cases of plague which were detected by corpse inspection were bubonic plague?—The great majority were during the months of January and February.

21,450. Were any of them cases of pneumonic plague?—Not at that time.

21,451. What proportion of the people who are sick do actually report their sickness and obtain certificates, in your opinion?—We could easily calculate that. The present population has largely increased, and is now about 130,000. It has increased from last June, when the city got very full indeed. Out of that number, 1,891 have been certified up to the end of the year.

21,452. Do you think that half of the people who are sick report themselves as sick?—I should not think as many as half.

21,453. Do you think anything like half do?—No.

21,454. I see that you certified 45 persons in the month of June, and examined 210 bodies in that month What proportion of the cases of sickness do you think

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were reported then?—That would be about one-fifth or nearly one-sixth.

21,455. Why would it be nearly one-sixth? It would be about one-fifth, assuming that almost everybody who fell sick and was not reported to be sick died of his sickness, would it not?—Yes; but, as I said before, it is almost impossible to tell, unless one went into all the districts of the city and found out which districts were reporting most cases of sickness and in which districts most deaths occurred during the corresponding period.

21,456. If all the mild cases of sickness were reported to you, would not you expect to find the number of cases of sickness far in excess of the number of deaths?—Yes.

21,457. Then in the months of November and December, when you certified 192 and 153 sick respectively, and when you examined 227 and 332 bodies respectively, a good deal of the sickness could not have been reported to you?—Yes.

21,458. Have the people here any objection to treatment by means of European medicines?—No. I cannot say that they have any great objection.

21,459. Do they prefer to be treated by their own medical attendants?—Yes.

21,460. Is the pardah system in force to any considerable extent here?—In certain parts of the city.

21,461. Among whom?—The Muhammadans.

21,462. (*Dr. Ruffer.*) Will you look at your statistics of corpse inspection of Poona city? (*See* Question No. 21,416.) In the month of January you had 90 cases of plague. I see that you had 63 cases unknown. Do you think some of them might have been plague?—These 63 cases were marked "Not plague" because no approximate cause of death was then required. This was during the height of the epidemic.

21,463. I do not understand why?—We either marked these cases as "plague" or "not plague." The diagnosis in these cases was that it was not plague. The approximate cause of death was not arrived at.

21,464. How do you know it was not plague?—The Medical Officer decided that.

21,465. How could you diagnose a case of plague pneumonia after death?—From the history and appearance of the body.

21,466. What appearance of the body or what history would enable you to diagnose a case of plague pneumonia from a case of ordinary pneumonia?—It would have the appearance of plague.

21,467. Supposing the man had no bubo?—In that case the clinical history would have to decide the point.

21,468. Suppose you had a case of acute pneumonia, how would that differ from a case of plague pneumonia?—It would not necessarily differ.

21,469. To what do you attribute the large number of cases of deaths from inanition in July, August, September, and October? I see the deaths from inanition jumped up from 24 to 59?—We include deaths from marasmus, lack of suckling, and deaths occurring among sickly and rickety children. At this time we had the rainy season, which is always a fatal time for weakly children.

21,470. To what do you attribute the great rise of death from bronchitis during September and October?—To extremes of temperature, cold chilly nights, followed by warm sunny days.

21,471. Does the Poona Municipality provide you with a microscope?—Yes, we have one at the Plague Hospital.

21,472. Have you the means of making a bacteriological diagnosis of a case of plague pneumonia?—No, but we are taking bacteriological specimens now, and we send them to Bombay for examination.

21,473. Have you an incubator and the necessary machinery for making cultivating media?—No.

21,474. Have you the necessary material for making cultivations?—Yes.

21,475. Then you can make a bacteriological diagnosis here in a doubtful case?—No; but we send to Professor Haffkine's laboratory.

21,476. Supposing you want to make a bacteriological diagnosis, would you make it here or would you send it to Bombay?—It would be sent to Bombay.

21,477. (*Mr. Cumine.*) Of these 3,035 people you have mentioned in your statistics of corpse inspection, was not the illness reported before death in any case?—That number includes all reported and not reported. This is a record of all the corpses seen from the 1st January to the 31st December, and includes cases reported during life.

21,478. With regard to these 106 deaths put down to plague, I understand you to say that you had received no previous notice of illness?—Yes. In this record we did not take into account the fact whether they were seen or not seen. This is only a statement of corpse inspection.

21,479. Do those 106 include cases in which the illness was reported before death?—No.

21,480. And cases in which the illness was not reported before death?—This only means *corpses seen in the city of Poona.* During the months of August and October two cases, which are marked "1" and "1" respectively, were seen by the Medical Officer, having been reported by volunteer gentlemen, and they were sent off to the General Plague Hospital, and died there. This does not include any which were seen by the Medical Officer and died in hospital.

21,481. Among those 106 corpses, were there *some* cases in which the illness had not been reported before death?—Yes, all of them, indeed, were cases "*not reported*" before death.

21,482. Are there some in which the illness had been reported before death?—None.

21,483. Can you tell us in how many cases the illness had been reported to you before death?—One case was seen by my brother (who was then my colleague) when *in extremis*, and death ensued in half-an-hour. Word was brought to him and he went back again. I think he had another case like that. These are all corpses actually seen after death. You cannot call them being reported in life, because the patient was in a moribund condition.

21,484. (*The President.*) Had you known of these 106 cases previous to the corpse inspection?—No.

21,485. I understand you to say that when you had information of a plague case in life you did not again examine the corpse after the patient died, but gave a pass for burial?—No, we saw the corpse.

21,486. Do you look at the corpse of every man who dies here?—Yes.

21,487. (*Prof. Wright.*) I understand that every case which is diagnosed as plague during life is sent to the Plague Hospital?—Yes.

21,488. Then his corpse is not re-inspected there, is it?—I do not know. We have nothing to do with the Plague Hospital's internal administration.

21,489. This does not include people who died at the Plague Hospital?—No; but yesterday morning a case was sent by my colleague suffering from plague, and the same day word was brought to me that that man had died from plague before removal to hospital, and that corpse was seen by me in the city of Poona.

(Witness withdrew.)

Prof. G. K. Gokhale.

Professor G. K. GOKHALE called and examined.

21,490. (*The President.*) You hold an office in the Fergusson College, Poona?—Yes.

21,491. What is your position?—I am Professor of History and Political Economy.

21,492. (*Mr. Hewett.*) You have only been employed during the second epidemic in Poona, I think?—Yes; I was doing work here as a plague volunteer during the time.

21,493. Between what dates?—From the middle of September to about the end of February.

21,494. What were your duties?—Up to the middle of November I had merely to accompany search parties

composed of soldiers, both British and Native. Afterwards, in addition to this duty of search I had to visit the detention and segregation camps on certain days, and advise the Superintendents of those camps upon matters on which they wanted to consult me.

21,495. Were you enabled to trace the source of the second infection at Poona?—No. The general impression here was that the poison was first imported from Kirki, but I am not sure that it was so, seeing that after the first epidemic we had stray cases occurring, say, one or two a week, in the town all through the intermediate months.

21,496. Have you any opportunity of discovering how a place gets infected with plague?—Yes. In my search work I often came across instances which appeared to me to indicate that the soil must be getting infected first, and that the infection must be spread chiefly through the soil.

21,497. What led you to form that opinion?—I found, for instance, that men who were sleeping on the ground floor were most liable to be attacked, while men who were sleeping on the first or second floor had very few cases among them. I also found that in the hospitals and segregation camps, where good care was taken to disinfect the soil, there were very few cases.

21,498. Do the majority of the people of the lower classes sleep on the floor without any beds?—They just put a mat or something like that on the ground.

21,499. How do you think that plague proceeds from an infected house to the neighbouring houses?—The process of dissemination seems to me to be this:—The poison in the system of a plague patient or of an affected rat or some such animal acts on the soil, if the soil is in a fit condition to be affected. Certain poisonous matter is then produced in the soil. The virulence of its infection seems to depend on the nature of the soil, and also, of course, upon atmospheric conditions. Persons who come into contact with such soil, and whose constitutions are not of a character to resist its power, come to be attacked. The infection seems to creep from the soil of one house to the soil of another, where the conditions are favourable. Affected rats, in many instances, carry the poison from the infected house to localities close by. Affected human beings carry it to longer distances, and thus form new centres of infection in congenial soils.

21,500. Have you had an opportunity of observing whether the infection proceeds by contact between human beings?—No, I do not think it does.

21,501. Or by clothes?—There were a few instances in which men who had come from Bombay were found to have brought the infection with them, though they themselves were not attacked.

21,502. Did you notice any affected rats in Poona?—Yes, several.

21,503. At what particular time did you observe them?—I specially saw them at the commencement of the epidemic.

21,504. In what months?—In September and October, particularly, I think.

21,505. Did you notice that plague was more virulent in any particular class of houses in the town than in others?—Yes. Generally, I found that houses which were damp, dark, and ill-ventilated were most exposed to the attack.

21,506. You are of opinion that the best means of dealing with it is to keep the patient away from the infected house?—Yes, the patient, as also the healthy inmates of the house.

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21,507. Have you had any opportunity of noticing the effects of disinfection?—I think so. Wherever these cases were discovered houses were disinfected, and it was then found that the infection did not spread to the adjoining houses; at any rate, not in the same rapid manner in which it had done so before.

21,508. Have the people here shown any objection to disinfection?—Yes, there is a natural disinclination to it.

21,509. Is this due to the feeling that it may destroy their property?—Partly. But there is personal disinfection as also disinfection of clothes.

21,510. Which do they object to?—They object to both, but personal disinfection is more disagreeable to them.

21,511. Are the people of a large town less inclined to move out into the neighbouring fields than the inhabitants of an agricultural village?—I should think so.

21,512. What are the reasons which would deter them from going out?—Their habits of life are such that they are not used to living in the open fields. Moreover, in large cities it is a costly thing to have huts put up, and many of the people cannot afford them. They are also afraid that their property, if left behind, would be stolen, and if they take it with them they are afraid of robbers.

21,513. Do you think that the people report the great majority of cases of sickness which occur in the town?—I think they do.

21,514. Before death takes place?—Yes. There may be a few cases where it is not reported, but, as a rule, they are now ready to report, because they know the advantages which they now secure by reporting.

21,515. How do you account for the great excess of deaths over reports of sickness?—Do you mean at present?

21,516. In the month of December last?—I was told that there was exceptionally heavy mortality among children, and that these cases were not reported.

21,517. Is your opinion based on facts?—I give you what I have heard.

21,518. (*Dr. Ruffer.*) Do you have many houses of two and three storeys in Poona?—Yes.

21,519. On what facts do you base your opinion that people in the upper storeys did not get plague so much as people on the lower floor?—For four or five months I was going about with the search parties. We found that most of the cases which occurred were on the ground floor.

21,520. Do the poorer people live on the ground floor?—Yes, as a rule. In fact, they live in houses which are only one storey.

21,521. Are the ground floors more crowded than the upper floors?—I think so.

21,522. Is there more ventilation on the upper floors?—Yes.

(Witness withdrew.)

Mr. VISHNU ANANT PATWARDHAN called and examined.

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21,523. (*Mr. Cumine.*) I believe you are a Municipal Commissioner?—Yes, at present. I was not during the epidemics. I received a letter from Sir Andrew Wingate stating that Government desired me to give evidence.

21,524. You have come to tell us about the city of Poona during the second outbreak of plague?—Yes.

21,525. Have you lived long in Poona City?—Yes, for more than 30 years.

21,526. Which were the plague operations with which you were connected?—(1.) The house-to-house visitation by soldiers and volunteers in search of plague cases. (2.) The segregation and quarantine camp at the Sawar's Gate. (3.) The disinfection and detention camp at the Poona Railway Station. And latterly I have been serving as a Chief Volunteer in charge of one of the wards into which the city has been divided for plague administration.

21,527. Will you tell us what lesson the experience of Poona especially impressed upon you?—When the plague broke out for the first time in Poona, no one knew exactly what measures to adopt, and every step that was suggested as possible to help the suppression

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of plague was adopted. The people were new to these measures. They were panic-stricken and they considered these measures to be more horrible than plague itself. The result was the concealment of plague cases *which helped the spread of the disease.* No plague measures should, therefore, be so severe that people will try to evade them. The maximum of efficiency should be sought for with the minimum of inconvenience to the people. The experience of Poona has fully taught us that it is with the co-operation of the people themselves that this end can best be secured.

21,528. Will you tell us what has been done in Poona during the last few months to prevent the re-infection of the town?—The whole city is divided into 16 wards. A native gentleman called a Chief Volunteer is entrusted with the sole business in connection with plague in that ward, and a European officer supervises his work. The Chief Volunteer finds out native gentlemen to co-operate with him voluntarily, and one to be in charge of each sub-division. A complete census of each house in the ward is taken and is kept corrected up to date. The householders are required to report all new arrivals, all departures, every illness, and every death. They have also been required to report the appearance of dead rats in any house. The volunteers in charge of each sub-division visit each house once a week to check the census. All new arrivals by rail or road are required to report themselves at the Ward Office, and are kept under surveillance for 10 days, that is, they are required to present themselves at the Ward Office every alternate day during this period, and their names are entered in the census if they stay longer in the city; but persons leaving Poona during this period are freely allowed to go. No one on the census list can go by rail or road without a pass from the Ward Office, and no one can arrive by rail and enter the city unless he is vouched for by some volunteer, and information as to the locality he comes from, and the place where he will put up on arrival, is furnished. If any passenger, released on surveillance, fails to appear at the Ward Office, the gentleman (volunteer) who vouched for him is called upon to produce him or to explain for his absence. Every illness is to be reported, and a Plague Medical Officer is to examine the sick person and certify to his illness. If any illness which is not previously reported turns fatal, the inmates of the house are kept under surveillance for 10 days. No corpse can also be removed from the house until examined by a Plague Medical Officer. In this way a watch is kept over every individual inhabitant, and any case of plague, indigenous or imported, is brought to notice within a short time. The sick person is then at once removed to hospital, the inmates of the house are kept under surveillance, and they are asked to vacate the house for disinfection. The first cases of sickness are thus detected, isolated, and effectively dealt with, and are not allowed to grow into so many different centres for dissemination of plague. Had this very thing been done in December and January 1897, when we had imported plague cases from Bombay, we would have probably had no epidemic at all, or we would have at least considerably arrested its growth.

21,529. Have you any figures to put in to show us how this organisation protected Poona?—From July 1898 to the end of January 1899 there were in all 28 cases of plague, 4 of which were indigenous and 24 imported. In each of these cases the measures I have described were taken, and we believe that these measures prevented each of those cases becoming a plague centre.

21,530. Do the inhabitants of Poona city themselves appreciate the importance of this organisation?—All plague restrictions are, of course unpleasant, but the people realise the necessity that they must choose the less of the two evils. I believe that people have learned the value of these measures.

21,531. Has the late infection of Poona been due to a Poona person or an outsider?—It is due to an outsider, a Bombay man, residing here for a short time, and having frequent communication with Bombay.

21,532. Was not the person in whose house he lived to blame?—The house was vacant and this man hired it, but we do not know whether the owner of the house looked after it and knew of this, and the consequent illness, &c.

21,533. Have you noticed during the first outbreak that one particular part of the city was affected and during the second, another part?—Yes. During the first outbreak the eastern part, and during the second the western part, were particularly affected. It was a remarkable feature in these outbreaks, that while the disease was seriously raging in the eastern part, only stray cases occurred in the western part, which did not form centres of infection; and that while it raged in the western part only stray cases occurred in the eastern part. In some instances, houses which were affected at the first outbreak were also affected at the second.

21,534. Have you any figures with regard to that?—Yes, I have figures only for three Pets which formed the western part. In Narayan Pet, from January to May 1897, there were 27 cases and 21 deaths; in Sadashiv Pet there were 96 cases and 79 deaths, and in Somwar Pet there were 82 cases and 60 deaths. That was during the first epidemic. During the second epidemic, that is, October, November, and December 1897 to January and February 1898, in Narayan Pet we had 195 attacks and 169 deaths, in Sadashiv Pet we had 544 attacks and 429 deaths, and in Somwar Pet 317 attacks and 260 deaths.

21,535. Where do you think the poison lies in an infected town?—My impression is that there is something wrong in the soil of the infected house. I also observed, looking to the situation of the houses, that the poison appears to pass or be carried from house to house.

21,536. Have you noticed on which floor people are affected most?—On the ground floor. I have prepared a statement for houses in the Narayan Pet, and there you will find a number of small blocks of houses affected. I have myself gone over these—I know the locality.

21,537. Will you tell us your deductions from it?—That a block of houses becomes infected, and when there is a patient in one house my impression is the poison passes along or is carried to and infects the soil of the next house. I say the soil, because I find that in hospitals and segregation camps and so on the soil is not affected, and no amount of contact affects the other persons, but it is the residence in an affected area itself which communicates the contagion. If there is one case in one house and the people continue to reside in that house, it is my experience that other cases follow in the same house.

21,538. How do you think the infection spreads from house to house?—In Poona the poison imported from Bombay grew in the soil of the affected houses and spread from house to house, *how* it is very difficult to say! Rats may be one of the agencies which spread the plague. They are also the first to be affected, and they serve as a warning to human beings to quit the locality. I know of houses where dead rats were discovered and removed, but where no cases of plague occurred. These houses are, however, well built and well ventilated, and were occupied by fewer inmates after the appearance of dead rats. I consider that poison is not carried from person to person by mere contact, however close, but is imbibed by a person by residence in an affected locality, which is not sufficiently exposed to the sun and breeze. The experience at the several hospitals supports me in this belief. I know of cases in hospital as well as outside hospital, where sick wives and other relations were attended upon night and day, and not even the vomit of the patient on the body of the attendant affected the latter. Some of these patients recovered and some died. The very small number of fresh attacks compared with the total number of admissions in the detention and segregation camps also supports this view. Native volunteers who accompanied search parties and entered affected houses barefooted or even touched sick persons were in no way affected. I have a statement showing the number of fresh cases in the several camps and hospitals.

21,539. Will you tell us what those figures are?—In the railway station detention camp from the 13th February to the 13th May, 13,606 people were admitted, and there were only 23 attacks. In the Bhamburda health camp from December 1897 to May 1898 there were 8,282 admissions, out of which 4,807 were from

infected parts, 2,935 were from arrivals by road and 540 arrivals by rail; that was when the railway detention camp was not ready. There was only one plague case. Then in the Sawar's Gate segregation camp from the 12th March to the 12th June 1897, 3,461 people were admitted and there were only 41 attacks. At the Hindu Hospital the rule was that each patient was allowed to have one attendant. There were 104 patients and an equal number of attendants, and among those attendants there were only two cases during the first outbreak, that is from the 15th March to the 31st May 1887. During the second outbreak from the 1st October 1897 to the 15th March 1898, 533 patients were admitted with an equal number of attendants, and among the attendants there were two cases, and two amongst the establishment, which numbered 57. In the General Plague Hospital from the 1st June 1897 to the 31st March 1898 there were 4,138 patients, and I take, as before, an equal number of attendants. No case of illness is reported among the attendants, but only among members of the establishment. There were 376 persons employed, out of which 26 were attacked.

21,540. Do you consider isolation of the sick to be necessary?—I consider the isolation of the sick to be necessary in the interests of the patient himself. If the locality of the house is affected, the patient has less chance of recovery by continuing to reside in the same house. Few people who continued in the same house recovered; while the non-removal of the first case led to several other cases in the same house. Instances of this can be given in numbers. Also about 20 to 30 per cent. of the cases which were removed to hospitals recovered.

21,541. What is your opinion of the importance of the evacuation of infected houses?—Evacuation of the affected house is also necessary in the interests of other inmates. Wholesale evacuation is highly objectionable especially in the monsoon and cold weather. If the persons who came in close contact with the patient leave the affected house that is quite sufficient. Where they should go is a question. I do not think all such persons, high and low, should be segregated at one place, as was done in the Poona segregation camp. Well-to-do, middle and upper class people, though they were willing to make their own arrangements to segregate themselves effectively, were not allowed to do so. If rich people go and occupy their garden houses, and if others go to reside in other vacant houses in an unaffected locality, I think they should be allowed to do so, provided they agree to remain under daily surveillance and medical examination at any of the Ward Offices. As to the lower classes, unless you provide accommodation for them, evacuation is a misery to them. They suffer by exposure to heat and cold, to which people living in crowded houses in a city are not accustomed. Inmates of neighbouring houses should be asked to vacate only in those cases where it is absolutely necessary to do so, but they need not be carried to health camps outside the city. They should be permitted to reside elsewhere in the city. If they are kept under daily surveillance for 10 days, that will be sufficient.

21,542. What have you to say about suspicious cases?—In suspicious cases the inmates were segregated even before the case was declared to be one of plague, and they had to undergo the pangs of segregation for nothing. This should be avoided. I have noticed in my own experience that a person who was subsequently found to be suffering from syphilis was removed as a suspicious case, and the inmates were then and there segregated and had to remain in the segregation camp for ten days.

21,543. You do not say, do you, that all the suspicious cases turned out not to be cases of plague?—No, what I mean is unless a case is declared to be plague the inmates should not be segregated. If we have a complete census of the locality we know who the inmates are and we can get hold of them, and when a case is declared to be plague they can be segregated.

21,544. Do you think that one central Plague Hospital is enough?—No. The ward hospitals, as in Bombay, are more suitable. We are naturally averse to remove our sick to hospital, but if a hospital could be provided for in the ward itself the *opposition of the people would be reduced and concealment of the plague cases would be discouraged.* If a separate house could be secured close by for segregating the contact people, so that they could frequently visit their sick and attend upon them, it would be all that could be desired. People in general have no faith in hospital treatment, and especially a central hospital as in Poona. The extreme desire of the people to go to their caste hospitals supports me to some extent in this view. In Poona the hospital and the segregation camp were at the two extremities of the town, one to the north and one to the south, which caused extreme inconvenience and irritation. The patient died in hospital and his relations did not even know of it in the segregation camp. Such a state of things is most repugnant to native feeling, and the remedy is to have the hospital and the segregation camp close to each other.

21,545. You attach great importance to this point?—Yes.

21,546. What have you to say with regard to disinfection?—On this point I am not in a position to give any decided opinion, because disinfection of houses was carried out, but I have something to say on the other side. Several dead bodies were found on the roads, and several deaths were reported which could not be traced as having occurred in any particular house, in which cases no disinfection took place either of clothing or anything else. These very clothes were, of course, used again, and my general impression is that the people continued to occupy those houses with safety and even used the clothes.

21,547. I thought you said it could not be found who the people were?—It could not be found to what houses they belonged, but they must have been residents of Poona. They must have belonged to some house, and my impression is that the people removed the dead body in order to free themselves of the consequences which would follow reporting the case. In those cases the houses could not be disinfected. Disinfection of affected houses was carried out with particular attention. Well-ventilated, spacious houses, exposed to heat and sun, which were surrounded by affected houses, could not have escaped the contagion. They were in several cases vacated and locked, or in some cases occupied by a few servants and others. They were not disinfected, and yet no cases occurred in them; and they were re-occupied with safety. What seems necessary is merely evacuation and exposure to the sun and air for some period. If the inmates desire to re-occupy the house early, it is safer to disinfect it and allow it to dry before it is re-occupied.

21,548. What sort of houses, in your experience, were the ones most affected?—My experience at the time of the house-to-house visitation showed that most of the houses affected were either old buildings with moist floors, or ill-ventilated and with insanitary surroundings; and in such houses more cases than one occurred, while the number of houses which were marked affected, but which were spacious and well-ventilated, was very small, and it was very doubtful whether they were at all affected. Out of 486 houses in Narayan Pet 84 were were affected, and out of them only about eight or 10 were good buildings. I have prepared a statement of these 84 houses which gives particulars, as follows:—

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STATEMENT of affected HOUSES and their CONDITION with DATES of ATTACKS from September 1897 to March 1898 in NARAYAN PET WARD, DIVISION Number XIV., POONA CITY.

Serial No. of House.	Dates of Plague Attacks from September 1897 to March 1898.				Total No. of Attacks.	Remarks as to Condition of House and other Special Particulars.
4	14.10.97	1.12.97	—	—	2	No plinth, has ground floor only, old rotten house, house occupied by Dhobis.
5	23.10.97	4.11.97	—	—	2	Has plinth in front but outside rotten, has ground floor, inhabited by Mahrattas, who make tin pots.
7	10.11.97	—	—	—	1	Rickety shed, as used for cattle.
10	2.11.97	—	—	—	1	Has no plinth, occupied by goldsmith, not ventilated.
14	11.11.97	—	—	—	1	One storeyed, is a good building.
22	29.10.97	—	—	—	1	Damp soil, no ventilation, old building, front part temple, back part used as residence.
23	11.12.97	—	—	—	1	Is gymnasium.
26	12.12.97	—	—	—	1	Rotten building used as a cattleshed, recently rebuilt
27	7.12.97	—	—	—	1	Rotten building, extremely dirty, no plinth.
30	27.12.97	—	—	—	1	Milkman's house, used as cattlesheds.
31	27.12.97	—	—	—	1	
35	1.12.97	2.12.97	17.12.97	—	3	Narrow space, a building of two Khans adjoining a garden. Old building ill-ventilated.
36	21.12.97	—	—	—	1	Residences of milkmen, no plinth. Extremely dirty sheds.
37	18.11.97	—	—	—	1	
54	8.12.97	—	—	—	1	No ventilation, moist floor.
69	30.11.97	15.12.97	—	—	2	There was no ventilation, windows made by Municipality recently.
90	4.11.97	—	—	—	1	Old ricketty building, moist, adjoining river.
93	7.12.97	—	—	—	1	No ventilation, no plinth, old building.
98	31.10.97	—	—	—	1	Stables, one-storeyed.
111	7.12.97	—	—	—	1	Old building, ill-ventilated, moist floor, dirty surroundings.
112	28.10.97	—	—	—	1	Temple, good building.
121	5.12.97	—	—	—	1	Overcrowded. A small wretched and close building without light and plinth.
135	30.11.97	—	—	—	1	Overcrowded chawl, and occupied by shoemakers, surroundings dirty and unhealthy.
142	5.10.97	—	—	—	1	Very dirty house adjoining river, moist floor.
154	13.11.97	—	—	—	1	Extremely wretched building, moist floor.
184	10.11.97	—	—	—	1	Ill-ventilated, no plinth.
197	14.11.97	—	—	—	1	Shoemakers' building, ground floor only.
206	22.11.97	—	—	—	1	No plinth, moist floor.
234	12.11 97	—	—	—	1	The old house destroyed and new one built.
235	10.11.97	—	—	—	1	No plinth, ill-ventilated.
250	27.12.97	13. 1.98	—	—	2	Adjoining garden, ill-ventilated.
253	7.12.97	—	—	—	1	No ventilation, no plinth.
262	12.10.97	19.10.97	4. 1.98	—	3	Overcrowded. Row of shops in front, old rotten building, moist floor.
265	12.12.97	—	—	—	1	Moist floor.
300	10.12.97	—	—	—	1	Old ricketty building, extremely dirty.
302	19.12.97	—	—	—	1	Sweeper's house.
321	4. 1.98	—	—	—	1	Windows opened by Municipality recently.
323	22.12.97	—	—	—	1	Old rotten house.
338	10.11.97	—	—	—	1	A row of four rooms on the ground floor, adjoining a garden, no ventilation and no plinth.
340	10.11.97	—	—	—	1	There was no case in this house. A patient in the Plague Hospital wrongly gave his address in this house. It was marked as affected, and the segregating party broke open inner doors and boxes and cupboards to search contacts. The owner had left for Berars and a servant was kept to watch. It is a newly-built and substantial building.
347	14.12.97	—	—	—	1	A close house without ventilation or light, and inside dirty.
348	12.12.97	—	—	—	1	A good building, proper ventilation.
349	5.12.97	—	—	—	1	A temple, a good building, clean, newly-built house; contagion caught in No. 362, opposite, the house on the other side of the road.
353	11. 1.98	—	—	—	1	A washerman's house, a wretched row of rooms on the ground floor, moist and dirty.
357	9.12.97	—	—	—	1	An old ricketty building without plinth, not well ventilated.
362	6.12.97	7.12.97	9.12.97	10.12.97	4	An old building on the ground floor, moist, not well ventilated.
363	21.10.97	—	—	—	1	Not a good house; vegetation in the rear.
365	23.10.97	23.10.97	—	—	2	Overcrowded. An old house, rooms on ground floor well ventilated, part one-storeyed, ricketty.
367	30. 7.97	—	—	—	1	An old ricketty house, moist and dirty.
368	10.11.97	—	—	—	1	Moist floor, rooms on ground floor, ill-ventilated, recently holes made by Municipality in the house.
369	18.12.97	—	—	—	1	A good building, well ventilated, but is connected with 367.
371	31.10.97	5.11.97	—	—	2	Barber's house, surrounding is dirty.
372	6.11.97	—	—	—	1	A narrow house, dirty, ill-ventilated, moist floor.
374	29.11.97	—	—	—	1	An old house without any ventilation.

Serial No. of House.	Dates of Plague Attacks from September 1897 to March 1898.					Total No. of Attacks.	Remarks as to Condition of House and other Special Particulars.
376	18.10.97	—	—	—	—	—	An old ricketty house, rooms on ground floor moist floor inside below the level of the road.
383	20.10.97	21.10.97	25.10.97	27.10.97	30.10.97		An extensive ground, let out on ground rent, where poor people have built rows of ricketty small houses on the ground floor, without any plinth, without any drainage; very dirty. After a few cases the inmates dispersed, but, when affected outside, came to die in their own houses. Hence the large number of attacks At the first outbreak no cases occurred in these houses. Was overcrowded.
,,	30.10.97	31.10.97	2.11.97	5.11.97	6.11.97		
,,	6.11.97	8.11.97	8.11.97	10.11.97	15.11.97	16	
,,	25.11.97	—	—	—	—		
390	2.11.97	6. 1.98	—	—	—	2	Dirty surrounding.
391	29.11.97	—	—	—	—	—	Old ricketty rooms on ground floor, ill-ventilated moist floor and surroundings dirty.
392	22.10.97	—	—	—	—	—	
398	16.11.97	—	—	—	—	—	Ill-ventilated, moist floor, narrow, one-storied building without open space, waste water drained through floor of house to the front road.
400	29.10.97	—	—	—	—	—	
402	21.10.97	22.10.97	—	—	—	2	An old building.
404	12.10.97	—	—	—	—	—	Milkman's house, used for cattle; inside dirty and ill-ventilated.
407	20.10.97	20.10.97	—	—	—	2	An old house, close, moist floor, one-storeyed.
409	14.10.97	—	—	—	—	—	Ground floor, extremely moist, ill-ventilated inside, no plinth, one-storeyed, old house.
412	5.11.97	—	—	—	—	—	Inside extremely wretched, moist floor, without light or ventilation; outside, one-storeyed ground building.
418	24.10.97	—	—	—	—	—	
420	9.11.97	—	—	—	—	—	An old one-storeyed house where cases occurred on the upper floor, ground floor moist.
421	13.11.97	—	—	—	—	—	An old overcrowded house, ill-ventilated, moist floor.
430	24.11.97	—	—	—	—	—	A part of the house old, and part newly built and well ventilated.
434	4.11.97	—	—	—	—	—	Ill-ventilated, surrounded by houses on both sides.
443	12.11.97	14.11.97	—	—	—	2	Ill-ventilated; inside, dirty and moist, rooms on ground floor in the rear, waste water drained through the ground of the house; outside, open and one-storeyed house.
448	26.11.97	3.12.97	5.12.97	12.12.97	13.12.97	5	House of a milkman, old rooms on ground floor moist, close to a garden. Cattle sheds.
449	31.10.97	31.12.97	—	—	—	2	Overcrowded. An old ricketty building on ground floor, moist and dirty.
454	30.10.97	—	—	—	—	—	Old house, no proper ventilation.
461	12.12.97	—	—	—	—	—	Old house, no plinth.
465	20.10.97	—	—	—	—	—	On the same level with road, moist floor.
466	7.12.97	—	—	—	—	—	No plinth.
472	9.11.97	—	—	—	—	—	A close house surrounded on all sides by houses, extremely moist floor, one-storeyed, without plinth.
473	4.11.97	25.11.97	—	—	—	2	A ricketty chawl, moist floor. Overcrowded.
477	30.12.97	—	—	—	—	—	New building, proper ventilation.
480	12.11.97	—	—	—	—	—	Old one-storeyed house, moist floor.
481	9.11.97	—	—	—	—	—	Good ventilated house, no plinth.
484	1.11.97	—	—	—	—	—	Very good building, ventilation proper, inmates say that there was no case in the house, occupied by a native doctor.

The floors are without any plinth, and moist during the monsoon and so on. Generally the houses had insanitary surroundings. In this very Pet 74 deaths could not be traced to any particular house, but my impression is that they must have been residents of the locality.

21,549. What have you to say with regard to corpse inspection?—Examination of corpses was strictly carried out. It ensured correct registration of deaths from plague, and enabled the authorities to trace out every affected locality where a plague death had occurred. In some cases the examination was delayed for several hours. With us, the dead body is to be removed from the house to the cremation ground as early as possible. But if a death took place at 10 p.m. in the night, the dead body had to be kept in the house till 10 a.m. next morning, to allow of its inspection by the Plague Medical Officer. This delay in the examination of corpses caused great annoyance. Corpse inspection is a necessary measure in times of a plague epidemic, but arrangements must be made for examination at all hours of the day and night. It is a necessary measure, but it should be carried out with as little inconvenience to the people as possible.

21,550. What do you think is the necessity for the measure?—If people conceal plague cases or do not report illness, that is a test by which we can ascertain even after death if there are signs of plague. I believe if every corpse is inspected there is a great guarantee of every plague case being detected.

21,551. Who do you think should have the duty of disinfecting and limewashing the houses?—I think that might be left to the owners themselves. If a rule were framed in Poona to that effect, we could very effectively carry it out by providing simply somebody to supervise that the work is done properly. If it were left to the people themselves, they would do it more carefully and willingly in their own houses.

21,552. Is there any other point you wish to lay before us?—Yes. I think that the plague measures should not be enforced equally in all cases. Captain Lockhart Mure, under whom I am at present working, made it a point to make certain exceptions in particular cases, modifying the rules. At the railway station he exempted high-class people from the disinfection of clothing and person, and even in the case of surveillance he allowed some, I believe, to be exempted altogether, and others were only asked to appear on the first and last days of the 10 days. They were, of course, educated people. I think that discretion should be used in enforcing the rules.

21,553. (*Mr. Hewett.*) When the plague broke out at Poona, was there a bylaw of the Municipality requiring deaths to be reported?—Yes, there was.

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21,554. Was that byelaw allowed to fall into disuse?—Even after the enactment of the byelaw the procedure was that the Municipal Inspectors of the different wards and the sweepers made inquiries of deaths and reported, or the constable at the nearest police station, who got information, reported it.

21,555. Did the byelaw impose the obligation on the householder?—Yes.

21,556. Was it enforced against the householder?—I think not.

21,557. (*Mr. Cumine.*) Is there any penalty for not reporting cases of sickness, at present?—Of course, the notification issued provides that people who fail to report will be prosecuted, but as a matter of wisdom this rule is not enforced, because, in plague matters, the officers do not like to go to the extreme with regard to prosecution. These measures are against the ordinary habits of the people, and although the people have to submit to them, the officers do not go to great lengths in the matter.

21,558. Is there any advantage held out to people to report cases of sickness?—Yes.

21,559. What is the advantage?—From June 1898, it was a rule that, if illness was previously reported and death ensued, the people were not put to any inconvenience, they were not segregated, nor even kept under surveillance, but if death occurred, and the people had not previously reported the case, they were kept under surveillance for 10 days.

21,560. Was that carried out?—Yes, for a time, until we had the present epidemic.

21,561. (*The President.*) You say in your précis, "It "is said that the inmates of the affected localities "should not be allowed to run over the whole place. "There is much truth in this." What is the truth?—It is likely that some of them might carry the germs of contagion with them, and though a small percentage, still some of them might develop plague.

21,562. Then that may altogether destroy some other measures which you may adopt by their spreading the infection all through the town?—The percentage of such infections, as shown by the results of the segregation camp, is so small that I propose that instead of taking them to the segregation camp they might be kept under surveillance, and if you could watch them for 10 days you could pick out any case which developed plague.

21,563. But the information you get with regard to sickness appears to be very imperfect?—But we should have the people under surveillance, which means they would have to report themselves every day to the Ward Office for medical inspection by the Medical Officer, or, in the absence of the Medical Officer, by the Ward Officer. That would be a guarantee that they would appear for inspection every day. In case they did not, we could find out what the cause was, and if there were any cases of plague we could take them to the hospital.

21,564. In those houses of the worst character which you refer to, where the plague was most prevalent, was there most overcrowding?—In some of the houses, but not all.

21,565. Are they the localities where overcrowding is most prevalent?—Yes, they are. There is a chance of more cases occurring in those houses, and I have noticed one or two houses where more cases occurred owing to overcrowding.

21,566. With regard to corpse bearers, do you find that they have been infected by bearing corpses?—I am not personally aware of that.

21,567. You have heard of no cases?—No, not where they were affected. But even if they were, there is one fact which we must bear in mind, and that is that usually the relations and neighbours of the deceased come to carry the corpse. If there are relations amongst them it is very probable that their death might be due to the original contagion they carried, and not necessarily from contact with the corpse.

21,568. You mean they might have become infected by coming in contact with the patient during life?—Yes.

21,569. You do not know of any instances in which direct infection appeared to be conveyed by carrying the corpse?—No. Mere contact is not sufficient to carry the contagion in my opinion.

21,570. (*Prof. Wright.*) Do you think any bodies are surreptitiously buried?—There was one case in the Sadashiv Pet where a dead body was reported to have been buried privately. It was found out and the man was prosecuted and punished.

21,571. Is it difficult to escape corpse inspection?—Yes; this was very early in the first outbreak.

21,572. Do you think it is difficult now?—I do not think any corpse could be surreptitiously buried now.

(Witness withdrew.)

Rai Bahadur B. C. Sathe.

RAI BAHADUR B.C. SATHE called and examined.

21,573. (*Mr. Hewett.*) You are a retired Deputy Collector living here?—Yes.

21,574. Were you employed in any plague duty in any of these epidemics?—Yes; I was employed as a volunteer in the ward in which I reside, that is the Sadashiv Pet.

21,575. During both epidemics?—In the first epidemic I served simply as a volunteer, but during the second epidemic I did a good deal under the Superintendent of the ward.

21,576. What were your duties during the second epidemic?—I was there to collect other volunteers to go round the Pet with the military to find out sick cases, to superintend disinfection of the houses, to report cases of sickness, also to report when corpses were found, and generally to do any work which was told to me by the Superintendent.

21,577. Are you at present employed on that duty?—Yes.

21,578. In reporting cases of sickness?—Yes, searching houses for sick persons, reporting them, and also, if necessary, looking after conservancy on the premises.

21,579. Had you any opportunity of observing how Poona got infected the second time?—During the second epidemic, the Kirki people came to Poona without any restriction and brought the infection.

21,580. Did you find the same places get infected in the second epidemic as in the first?—At first it was rather peculiar. The places which were secure from the first epidemic got the second epidemic at first, in that part of the town which was considered to be fairly clean

21,581. Did you notice that any houses which were well ventilated, and of good structural condition, had plague cases in them?—That is my humble opinion, especially with reference to a particular part of the town, namely, the south-western portion of the town somewhat near to the river.

21,582. Do you mean that in the south-western portion of the town some good houses were attacked?—Yes.

21,583. Is that the part of the town in which the best houses are?—I would not call them the best houses, but they are in the best locality, I should say. The houses are of an ordinary nature, but they are on a raised platform and have sufficient air and light, having back and front verandahs, and there the infection for a time raged very high.

21,584. Were they private houses or lodging houses?—In some of them the owners lived with lodgers also. We have very rarely different lodging houses and private houses; they are all jumbled up together.

21,585. Did the people show a dislike to leaving the town and going to camp?—They did not. As far as they could, they left *en masse*. At least, three-quarters of the Sadashiv Pet people ran away to different places. I have locked and sealed very many houses in Sadashiv Pet where they were kept vacant by the owners.

21,586. You did not find them averse from leaving their houses?—When they found it convenient to go away voluntarily they went away.

21,587. Do you mean that they did not like to go away if the plague authorities suggested it to them?—When people of their own free will could make proper accommodation for themselves they went outside, but when

they found their means not sufficient to do what was necessary outside they were reluctant to go.

21,588. Were the great majority able to make arrangements or not?—The great majority were able to do it.

21,589. Did you disinfect the houses in which plague cases did not occur as well as those in which plague cases did occur?—In Sadashiv Pet all the houses were disinfected.

21,590. Do you think that is necessary?—As it was carried out during the second epidemic the disinfection consisted of two portions. The first was disinfection with some mercurial liquid, and no one will object to that. But secondly there was disinfection by the spreading of quicklime on the floor, and most people objected to that very much. Although I cannot pronounce any scientific opinion about it, yet I say from experience that our people in their own houses, and all children, go about without any covering on the feet, and the spreading of lime over the floor keeps the feet burning for a number of days. The people very much objected to that, but they did not care about the liquid.

21,591. Do you think that it is unnecessary to disinfect a house adjoining a house in which plague has occurred?—I think the solution is all that is necessary. I think that the quicklime is not necessary unless the house is very bad.

21,592. I understand you to mean that houses where cases of plague have not actually occurred, but which adjoin such houses, should be disinfected, but that it is sufficient to disinfect them with perchloride of mercury?—Yes.

21,593. Did any instance come to your notice in which after a house had been thoroughly disinfected the people re-occupied it and cases of plague recurred in it?—I am sorry to say that in Sadashiv Pet such cases may have occurred, but I cannot remember that at this moment, because as soon as there was a case so many people left the place and did not turn up for a couple of months.

21,594. Do the great majority of the people here sleep on the floor or on beds?—Many of them sleep on the floor with hardly a mat.

21,595. Do you find the people are now ready to report all cases of sickness?—My own impression is that they have got thoroughly used to the system which has been prevailing for the last six months, and that they always do their utmost to report cases to the office.

21,596. How many cases of sickness have been reported in your own ward during the past week?—I think about 8 or 10.

21,597. How many corpses have been examined during the same week?—About 10 or 12 were inspected.

21,598. Then all the cases of sickness were not reported?—I will tell you how it was. Some of those sick cases were considered to be suspicious, or thought to be plague cases, and some of them were removed to the hospital, and when the fatality took place in the hospital we had nothing to do with it.

21,599. Do you only report severe cases of sickness?—No; all cases of sickness that come to our notice are reported and we leave it to the Medical Officers to decide whether it is or is not a plague case.

21,600. What is the population of your ward?—I believe about 5,000 or 6,000.

21,601. It is very healthy if there are only 8 or 10 cases of sickness in the course of a week, is it not?—I believe we have enjoyed a pretty good time during the last five or six months.

21,602. (*Prof. Wright.*) Were any of those 8 or 10 cases plague cases?—In the last week there were some plague cases.

21,603. Then you ought to add to the corpses which have been inspected also the corpses of those who died in the hospital?—We have nothing to do with the corpses of people who died in the hospital.

21,604. But if you added those to those which you examined in your ward you would have more dead bodies than cases of sickness, would not you?—Yes.

21,605. (*The President.*) Were there many cases of plague in the second epidemic?—There were very many cases in the second epidemic in the ward to which I belong.

21,606. How many?—I think about three or four hundred or even more.

21,607. Between what dates was the mortality very high?—From the 12th September 1897 to the 7th February 1898.

21,608. What ward was is it you refer to where the houses are in good condition?—I refer to my own ward, the Sadashiv Pet ward.

21,609. Are all the houses in good condition there?—I think most of them are in fair condition.

21,610. There are no bad houses?—Very few.

21,611. They are a better class of people?—Yes.

21,612. Did many slight cases of plague occur in any one individual house?—There have been some such houses where three, four, five, and six cases occurred.

21,613. One after the other?—Yes, and simultaneously sometimes.

21,614. In these cases where they occurred one after the other were the cases which first occurred removed? Were they removed one after the other from the house?—In some cases the first case was removed and the house disinfected. Then between that disinfection and the first attack another case cropped up which proved fatal. Then that case was removed. Sometimes when these cases were going on unfortunately there was a third case fatal at once, perhaps through fright. The people in most cases got it because they lived in a close atmosphere and in very small rooms.

21,615. Could you give us a statement of the houses in which plague occurred, showing the nature of each house, the total number of people living in each house and the number of rooms, and including the kind of floor and the means of ventilation?—Yes. I have prepared two statements of all the houses affected, giving the above particulars, and these may be abstracted as follows:—

	Number of Houses.	Average Number of Persons in each House.	Average Number of Persons attacked.	Average Number of Deaths.	Nature of Ventilation.	Kind of Floor.
Class I.	70	16	2	1·4	1 fair, remainder good.	Mud.
Class II.	113	14	1·8	1·3	4 fair, remainder good.	Mud.
Class III.	81	12	1·7	1·4	1 fair, remainder good.	Mud.

21,616. Have you anything else to say?—I would like to bring to the notice of the Commission one thing with regard to locomotion by railway. In the matter of locomotion there was a great cry all over the place that there was no uniformity of procedure adopted. For instance, things which were considered sufficient by the Poona authorities were not considered sufficient by the neighbouring district authorities or Native States where the Political Agent's will was supreme. In fact, the rules with reference to locomotion varied in each district, and consequently people who were obliged to travel from one place to another were placed in an awkward position, not knowing whether it was safe for them to travel or not. In many instances I have found people who wanted to go to a place and come back within two or three days, who did not know whether it was possible for them to do the journey within the specified time because at the place they were going to there were certain rules against which they could not guard themselves beforehand. What we all wished was that anything which might pass with one authority, might also part with another authority, unless in the meantime the circumstances of the traveller undergo a change.

21,617. You have found the differences very inconvenient to travellers?—Yes.

(Witness withdrew.)

Assist. Surg. E. S. Bharucha.

24 Feb. 1899.

Assistant-Surgeon E. S. BHARUCHA called and examined.

21,618. (*The President.*) You have had hospital experience, I think?—Yes, partly hospital, and I was also in charge of the Flying Column No. 4 at Kaledhon in the Satara district.

21,619. (*Prof. Wright.*) Where were these flying columns equipped?—There were about eight columns and they were organised in Bombay. My column was No. 4.

21,620. Was the column organised when you took charge of it?—No.

21,621. Then you had to do the organization yourself?—Yes.

21,622. Who were the men in your column? How was the gang recruited?—I was the head of the gang, and under me there were three Hospital Assistants and three medical students from the Byramji Jeejeebhoy Medical School, Poona.

21,623. How many men were there in the gang?—Besides the above we had six sweepers and a dozen coolies, and, in addition to that, more than 50 men locally obtained direct from the place.

21,624. Were you supplied with pumps?—Yes.

21,625. What sort of pumps?—At first I had a few brass pumps, but afterwards I had a large supply of wooden pumps sent by the Surgeon-General.

21,626. How did you get the disinfectants?—I got them direct from Bombay by making requisitions from time to time on the Surgeon-General.

21,627. What disinfectants did you use?—We used in the early beginning phenyle and carbolic acid, because I found it locally there.

21,628. You had nothing with you when you began?—No. I was sent out from Poona without any notice. What I found there was a few brass pumps, phenyle and carbolic acid. These were supplied to me by the Collector at Kaledhon.

21,629. Do you know where they got that?—They must have got them direct from Bombay. On my going there I represented my requirements to the Surgeon-General and within a fortnight I received a full stock of instruments and disinfectants from Bombay.

21,630. How did you make up the disinfectant used by your gang?—I used to make it up with four ounces of corrosive sublimate and eight ounces of common salt which I obtained from the bazar, and added 30 gallons of water. I had wooden casks supplied to me which held about 30 gallons of water.

21,631. What strength does that make it?—Approximately 1 in 1,000.

21,632. Did the whole of the perchloride of mercury dissolve?—Yes, very nearly.

21,633. Did you take it out with you for your disinfection operations in that solution?—I used to have packets made up and sent round to all the different members of the staff. Each packet contained four ounces of the corrosive sublimate and eight ounces of salt which was dissolved in water in these casks. These casks were supplied from Bombay and they held 30 gallons of water.

21,634. Was it hard or soft water?—It differed, but in most places it was hard water.

21,635. Before you went down to Kaledhon I think there was cholera reported?—It was reported in Kaledhon and the district round about.

21,636. Do you think this cholera has any connection with plague?—I do not think so. My own belief is that most of those cases of cholera which were reported were, properly speaking, cases of plague. Nobody had an opportunity of seeing them; there were no medical men on the spot. It was an out-of-the-way spot altogether.

21,637. Is there any symptom of plague which might have been mistaken for cholera?—Not so far as medical men are concerned, but I think ignorant people could mistake it; or possibly it was returned as cholera in order to prevent the difficulties which would arise if plague were reported.

21,638. You think that any epidemic disease would be reported as cholera by the villages because they know that best?—I believe all these villages were reported as having cholera before plague, but no village which was affected after my taking over the charge was shown to have had cholera before plague.

21,639. You say in your précis that the evacuation of infected villages is very effective when it is carried out early; have you any instance in which evacuation was very effective?—Yes, I have instances where evacuation was carried on by the people voluntarily. One such village was Valuj.

21,640. Were you on the spot?—Yes.

21,641. When did you first get notice?—On the 16th October 1897, and I visited the place on the 17th or 18th October.

21,642. How many plague cases had there been?—Ten cases of plague had taken place before I went there. I believe plague was probably there two or three days earlier than that, but they were all discovered on the 16th. When I arrived there I was surprised to see the people had of their own accord gone out to live in the fields—almost the whole village.

21,643. How many inhabitants has this village?—Approximately about 800 people. I found it entirely empty with the exception of two or three village officers in charge.

21,644. Did the people go back into the village?—Not for a month-and-a-half.

21,645. Did not they go back from day to day to fetch things?—They were almost all agricultural people, and had very few wants. They took everything from their houses and lived in camp.

21,646. How many plague cases occurred after evacuation?—On the 16th and 17th there were 10 cases, and then there were no cases on the 18th, 19th, 20th, 21st, 22nd, and 23rd, not even in the fields.

21,647. How did you know there were no cases? Did you go round to the huts?—Not personally, but my assistants went round the huts. There was a regular searching carried out. On the 24th two cases were reported. These were in the same family which had been affected before. Then on the 25th another case was reported, on the 26th another; on the 27th there was no case, on the 28th there were three cases, and then practically the disease disappeared.

21,648. Did you stay on the spot until the 28th?—I was not in the same village, but I visited it every second or third day. I had a number of other villages to look after.

21,649. After the 28th you say there were no other cases?—There were cases, but I know how those cases occurred. A man had been living in the village who was one of the village officers and a Brahman. He was not an agriculturist, and did not know where to go, and he lived in the outskirts of the village. I believe he got his infection from the village. The second case which occurred after that was the man who attended on him.

21,650. And then did the plague epidemic stop?—Yes, there was no more of it. There were altogether 19 cases there. That is an example of a village where voluntary evacuation was carried out with good results.

21,651. Do you often find that buboes are small at the beginning of an epidemic?—Yes, even smaller than a betel nut.

21,652. Were these cases very severe?—Yes. Comparatively speaking they were more severe than those where the buboes were more marked. I have often observed that. They are almost invariably fatal.

21,653. Did you see any mild cases of plague, so-called *pestis ambulans*?—I have said in my précis that in one village an outbreak of mumps preceded an attack of plague, and this was also noticed by me in Poona. I was in charge of the observation wards of the Sassoon General Hospital there. From a particular house from 20 to 25 famine children were brought in—it was famine time then—all suffering from mumps. One of them afterwards developed characteristic symptoms of plague. She had mumps, and afterwards developed a buho in the groin, and all the other characteristic signs of plague.

21,654. You have seen this also in the plague-infected villages, I understand?—In one village, Mahuli.

21,655. Was that at the beginning of the epidemic?—Yes; in fact, I diagnosed these cases as mumps at

the time, but I now believe they were cases of *pestis ambulans*.

21,656. Did these symptoms only occur in children?—In Poona only in children, but in my village they were in men, women, and children.

21,657. Then I believe you have seen an association of small-pox with plague?—Yes. This has come to my notice in three villages. In one village very near my headquarter station, named Chitale, about 14 cases of small-pox had taken place before plague occurred there. The early cases of small-pox were not seen by me, but by the vaccinator of the district, and he proposed vaccinating the remaining part of the population, but the people refused. Then in the same family where the last two or three cases occurred, I was told there were some cases of fever, but there were no signs of small-pox. I went to see them. I could not come to any conclusion, because these cases of fever which occurred were in the same family where the cases of small-pox occurred, and I thought they might be cases of small-pox without any eruption, although I had never seen such cases. I deferred the diagnosis until the next day, when one of the two suspicious cases died and the other developed a bubo. From that time onwards regular cases of plague were seen.

21,658. You say that sometimes the incubation period has extended to 14 days?—Yes, I have noticed it in a case in Poona. I believe this case was probably reported to you by Col. McConaghy in Karachi. It was a Parsee child who arrived in Poona on the 3rd December 1896. She came from the district of the Fort in Bombay where plague was then raging very fiercely. Thirteen days after that the child was doing well. On the 14th day I was called in to see the child about two o'clock in the afternoon, and she had a temperature of 104, which in the evening went up to 106.

21,659. When did the child get this temperature?—On the 17th December, the 14th day after arrival from Bombay.

21,660. Do you think the child may have had clothes on her which came from the infected district?—I do not know.

21,661. (*Dr Ruffer.*) Was there any plague in Poona at that time?—In the cantonment where the child was living there was no plague then. *Assist.-Surg. E. S. Bharucha.* 23 Feb. 1899.

21,662. Was there any plague in Kirki?—Long after that.

21,663. In the town?—There were suspicious cases beginning to come, but there was no reason to believe that this child had access to the city.

21,664. (*The President.*) With regard to those cases of mild plague which you mistook for mumps, was the swelling on one side or on two sides?—Sometimes on one and sometimes on both, in the parotid region.

21,665. Was it infective?—I considered them as infective, because there were so many other children brought from the same place. They all recovered, with the exception of the one who got the bubo in the groin. That case was transferred to the Plague Hospital and died there.

21,666. You think the duration of an epidemic may be greatly modified by the measures which are adopted?—Yes.

21,667. Especially by what measure?—I believe two measures are of the greatest importance, viz., early and complete evacuation if you can get early notice, and a careful searching of the fields and the removal of any plague case occurring in the fields to hospitals, and separating those people from the healthy. In the village of Lengre where this searching was not done very well, plague continued some time, so I had the fields searched under my own supervision, and succeeded in bringing out 10 cases in one day, whereas formerly only one or two cases where reported. For only two or three days after this cases came to be reported, and subsequent to this no more cases occurred, and the place up to date remains uninfected.

21,668. Can you give us an example in which the duration lasted for only a fortnight?—It lasted 16 days in one village named Chitale, and 21 days in the village called Valuj.

21,669. Were the measures there completely carried out?—Yes. In the village of Valuj there was voluntary evacuation.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Council Hall, Poona.

FIFTY-FIFTH DAY.

Friday, 24th February, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Major W. L. READE, R.A.M.C., called and examined. *Major W. L. Reade, R.A.M.C.* 24 Feb. 1899.

21,670. (*The President.*) You are on Special Plague Duty here?—Yes.

21,671. As the Chief Plague Authority in Poona city?—Yes.

21,672. When did you assume this office, towards the end or at what time, relatively, to the first epidemic?—I came out originally in February 1897.

21,673. So that you can speak of the first epidemic?—I was here for several days at intervals during the first epidemic.

21,674. When did the first epidemic commence here?—It commenced here in December 1896.

21,675. Was it discovered how it originated?—I think there was very little doubt it was communicated from Bombay by train. I do not think that has ever been traced accurately, but I think there is little doubt it was by railway intercourse.

21,676. Would you give us an account of the first epidemic in Poona and the amount of the plague which occurred?—It was about the middle of February that measures were first taken for search parties and compulsory isolation of the sick in hospital.

Major W. L. Reade, R.A.M.C.
24 Feb. 1899.

21,677. You are aware of the account* which has been written of the epidemic?—Yes. Dr. Lowson and myself were in an advisory capacity to the Committee. We used to advise the then Chairman of the Committee with regard to measures we thought necessary.

21,678. You adopt this account of Mr. Rand's as being an accurate account of the epidemic?—Yes, I have read it, and I take it as an accurate account.

21,679. Do you know when the first epidemic terminated?—It was over at the end of May 1897. There were a few dropping cases in May. Then during June and July occasional cases occurred. The total mortality, however, was heavy; it was accounted for by cholera, there was a cholera epidemic at the time.

21,680. When was Poona entirely free from plague after this epidemic?—There was an interval during June and July. With the exception of, I think, one case in July, it was practically free in June and July 1897.

21,681. When did plague again appear in Poona?—There were imported cases from Kirki in August 1897.

21,682. Did that constitute the commencement of a second epidemic?—Of course it is difficult to say whether it might have been what is called an indigenous outbreak. I have no evidence of that, but there was direct evidence that Kirki was infected, and we have direct returns of imported cases from Kirki.

21,683. Could you describe the course of this second epidemic, starting in August 1897?—There were four imported cases on the 30th July from Kirki. That was practically the start of it. Then there was one on the 1st of August, one on the 7th, and one on the 9th of August, and so on. Then it went up to an average of about one a day. Then the indigenous cases commenced, I mean the indigenous cases were above the imported cases, but during all that month of August we had continuous records of imported cases from Kirki.

21,684. What was the course subsequently?—I was not here during this time from August to September, I came here in October. On the 11th September there were 14 cases, then it went continuously upwards, and on the 20th November there were 400 cases a week. It reached its acme on the 11th December, and then from that day there was a continuous fall down to the end of February 1898.

21,685. Could you give us the total number of cases in this epidemic?—The total mortality from plague was 3,633, and the cases were 4,644.

21,686. What has been the history of plague in Poona since February 1898, when the epidemic you have just spoken of terminated?—Since February 1898 to February 1899 we have only had imported cases. The last week we have had a little outbreak in Sadashiv Pet from an imported case from Bombay, in which we have had the so-called indigenous cases, but which have resulted from the imported ones.

21,687. You remained practically free until this month?—Yes, until this month. We have had 30 cases in the last nine months, since the epidemic of 1898.

21,688. These were all imported cases?—Yes, all of them.

21,689. Are you in a position to state briefly what were the measures employed during the first epidemic?—Rigorous isolation of all the sick in hospital was carried out, compulsory detention of the contacts in segregation camps, and disinfection of houses and clothes, and there was an organisation of search parties by British soldiers and sepoys accompanied by native workers.

21,690. And the segregation was a partial one, as far as I understand?—It was compulsory detention in a segregation camp in the 1897 epidemic. Evacuation was not carried out in this epidemic. There were no health camps. From February 1898 to the present date observation of contacts has been carried out.

21,691. Is the rapid decline in the first epidemic, from December 1896 to the end of March or April 1897, coincident with any plague measures that were adopted?—Undoubtedly.

21,692. Which plague measures?—The measures which were brought into force, namely, the isolation of sick into hospital, and the segregation of the contacts.

21,693. There was a decline, and I understand you to say that took place after these measures had been adopted in the first epidemic?—There was, I think I might say, a continuous fall in the first epidemic.

21,694. What measures were adopted in the second epidemic?—In the second epidemic we relied more on the help of the native people, and we gradually lessened the strictness of the measures, and after a time we modified them more. We have done away with the compulsory detention of the contacts in a segregation camp, and we have lessened our measures quite recently with regard to hospital treatment, but I think the chief measure was the lessening of the strictness of our segregation system. We created a system of open segregation by which people were allowed out during the day, and they had to report themselves at night. We had a roll-call every morning.

21,695. Previously, they were kept in the camp?—Yes, in a guarded camp.

21,696. In the second epidemic how long were they segregated?—Ten days.

21,697. What was the treatment of the evacuated houses?—Thorough disinfection with perchloride of mercury.

21,698. To what extent was evacuation carried out? What was included in the evacuation in the second epidemic?—In the second epidemic we rarely disinfected more than one house unless we had some evidence to show that the adjoining houses had been contaminated. We judged each case on its merits, and if there was likely to have been freedom of intercourse between the adjoining houses, the Plague Officer had power to disinfect this house also; but it was not a rule.

21,699. Were those measures adopted at any particular stage in the second epidemic, or throughout the epidemic?—We depended more on gaining the confidence of the people, and we elaborated the volunteer system more, and formed Chief Volunteers. Colonel Creagh and myself were appointed to the then existing Committee, and I think the principal change was the appointment of Chief Volunteers, who went round in a spirit of conciliation; and more power was given to them, and now they are appointed the Chief Executive Officers of the Pet.

21,700. Were the measures adopted in their full development at the commencement of the second epidemic, or were they elaborated during the course of that epidemic?—We changed the measures to this extent, with regard to the searching more particularly; before, the searching was done by one centralised party, and then the other system came into force—what one might call the decentralised system—by which the Superintendent was appointed the plague official for each Pet, and he was the responsible officer for that Pet.

21,701. What was the effect of all this modification?—These measures came into force about a week before the fall, the 27th November is put down as the date of the revised measures, and from the 11th of December there was a continuous fall.

21,702. What essential difference had existed in the treatment of your plague measures anterior to the fall, as contrasted with the measures which took place at the time of it or subsequent to the fall?——I think the most important one was undoubtedly one of organisation, a decentralisation by which each Plague Officer was made responsible, and he had his own equipment complete. He was the Plague Officer of the division to whom all the inhabitants of that particular Pet could apply. There was a plague office established in each of the plague divisions.

21,703. Putting aside the fall in the mortality, what do you think was the valuable result of this change of organisation that you speak of?—I think it gave more confidence to the people.

21,704. In what way?—That they had someone to apply to.

21,705. Did it result in your getting better information as to the cases?—Undoubtedly.

21,706. You got better and more reliable information?—Certainly.

21,707. Your information before was not so good, and, therefore, you could not carry out segregation so thoroughly?—I think one would argue that was so.

* "Report on the Poona Plague Operations," by the late Mr. W. C. Rand, I.C.S., Chairman, Poona Plague Committee, printed on pp. 301 to 357, Vol. II., of "The Plague in India, 1896-97," by R. Nathan, I.C.S.

21,708. The more perfect your means of obtaining early information, the more perfect were your measures?—Undoubtedly.

21,709. The plague continued to increase until this improvement of measures had been attained, I believe?—Yes.

21,710. And then it fell rapidly?—Yes.

21,711. What are your views with regard to evacuation?—I think, from the experience I have gained of evacuation, that it is a most valuable measure. On the other hand, I am not at all sure whether a lesser alternative might not be as efficient. If we get early information of cases I am inclined to think, from our experience here, that one can limit the zone of infection; that being so, evacuation would be unnecessary.

21,712. With that condition, that you have a limited zone of which you have information?—When I said a limited zone, I meant more particularly that each particular case could be limited to the house in which it occurred. In our experience here up to now, January 1899, we have been able to limit the spread in this way, and even if several cases arise, these can in a large town be prevented from spreading by prompt action. Of course I am speaking now of one's experience of limiting plague in a big city, which experience is naturally extremely small.

21,713. Your experience has hitherto been of cases where you have had early information of isolated cases, not more than one or two in number; in that circumstance what action do you consider sufficient?—We have been able to limit the plague to the particular spot in which we get information of it, by the patient going to hospital, or if a corpse was found, the corpse being removed, and the people in the house being placed under surveillance, disinfection of the house, and disinfection of the clothes of the people who inhabited the house being carried out.

21,714. If the area affected be a larger area, you may require to modify those measures, may not you?—Just now one might say that this system is on its trial. This particular outbreak we have now is more or less confined to a block of buildings about 100 yards square, and I was inclined to think that it was due to some infective agency that we had not before in Poona, rats or something like that; but I still think that our operations will be effective to treat this block in the same way as we treated the cases before, and without evacuation.

21,715. Not paying any attention to the immediately contiguous houses?—No; unless we have evidence that there has been some direct contact. A house leading into another house, perhaps without any wall, and where neighbours are known to have had intercourse with each other, would be disinfected.

21,716. You would treat contacts in the same way as actual patients?—We would treat that house in the same way as we treated the other house.

21,717. Why do you think removal from the house to a health camp, or isolated place, stops the extension of the plague?—You get away from the infected floor, and you disinfect the infected clothes. I think both the floor, and particularly the clothes, are very infective—as far as I know they are the only factors, with the exception of pneumonic sputa, that have proved to be infective.

21,718. Is there any other factor which may explain the good results of removing people into a health camp?—They are placed under better hygienic conditions.

21,719. What evidence is there, to your knowledge, that that is an operative condition?—It is a presumption that if you take people from ill-ventilated houses, and place them in good airy houses, that the hygienic conditions are better, and one can say that under better hygienic conditions the general health will improve.

21,720. As a general principle?—Yes.

21,721. Have you any experience with regard to segregation camps which would lend weight to your supposition? In these segregation camps was the general hygienic condition the same as in the localities from which the inmates had been removed?—No, much better.

21,722. You have stated that you consider that infection is due to the infection from floors and clothes, and from pneumonic sputa. What influence do you consider rats or other animals to have upon the spread of plague?—I have had no direct experience of the spread of plague by rats, although from what one reads one is inclined to think there must be something in it.

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21,723. Do you know if any large number of rats did die here during any of the epidemics you have been concerned with?—No, we have never had a large mortality in rats.

21,724. There was no warning given in any house where plague occurred by the death of rats, of the possibility of plague occurring in the house?—No; we have received reports of rats having died, but I do not know that I can remember having seen a dead rat in Poona. I certainly have not seen any in this last outbreak.

21,725. Why do you think that the condition of floors is a great means of propagation of plague? On what data do you make that assertion?—Because if you move people from those floors they do not get the plague.

21,726. Have you ever removed them without also disinfecting?—Their clothes were disinfected on arrival in camp. I have said in my précis of evidence: "In "the infection caused by floors I also include infected "clothing."

21,727. How do you think floors would retain the plague virus and thus become a special means of propagating plague?—I think that any floor that contains material for the propagation of germs will retain them longer, and be a more favourable bed for their spread.

21,728. What kind of floors were they?—Mud floors.

21,729. Such as would be favourable for the retention of organic matter?—Yes.

21,730. Would that extend to stone, or wooden, or concrete floors?—That I have very little experience of. There are practically no floors of that sort in Poona.

21,731. You wish to speak of mud floors, which contain greater organic matter?—Yes.

21,732. I think that, generally speaking, you are of opinion that pneumonic cases can be detected by medical examination?—Yes.

21,733. Will you tell us how you detect such cases?—One arrives at it by a process of exclusion mostly. There is a history of cough, and there is sometimes a very frothy condition round the mouth of the corpse—a congestion round the mouth and nostrils.

21,734. Supposing you found a person who was ill, how would you form the diagnosis of pneumonic plague? On what grounds would you arrive at a conclusion, before death?—One would naturally go by a bacteriological test, had one facilities for doing so.

21,735. I ask you, because you have made the statement that a pneumonic case would be detected by medical examination before it develops into the contagious stage?—That is, during life in a health camp.

21,736. Assume it is in a health camp?—Because these people in the health camp who are under medical observation would, on the first sign of fever, be put into an observation ward before they develop into the pneumonic stage of plague.

21,737. You mean, then, not so much the discovery of the pneumonic plague as the prevention of harm from any possible pneumonic cases?—Quite so.

21,738. You had no certain means of detecting pneumonic plague, had you?—No. I mean they would be detected before they developed into the pneumonic condition.

21,739. Have you any experience with regard to inoculation as a plague measure?—No. I have been in villages in the district with Professor Haffkine to assist him, but I have had no experience.

21,740. Have you formed any opinion as to its value as a plague measure?—I think it may be of value in segregated communities, such as people in jail, and in regiments. Universal inoculation seems to me to be a difficult thing to carry out.

21,741. Assuming that it is really preventive, you mean that it is limited in its applicability?—Yes.

21,742. Have you had any experience of the re-infection of any houses which have been disinfected?—No, none at all.

21,743. Have you had any experience of cases which suggest recrudescence of the disease, that is to say, apart from a fresh importation?—No.

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21,744. You do not believe in recrudescence in the soil?—I must say I do not now. I was quite prepared to believe in it, but with the experience that one has now had, I do not think that belief was justified. I can only argue from an extremely limited amount of experience from a plague point of view, but, judging more particularly from Poona, a city which has been badly infected for two years, if there is such a thing as recrudescence in the soil, I think one would have had an outbreak before now.

21,745. In the meantime, experience shows you that plague does not occur without any direct infection from either clothing or persons?—Undoubtedly, it does not occur without direct infection.

21,746. With regard to disinfection could you describe what disinfectants you have employed here?—We have employed always the perchloride of mercury solution, 1 in 1,000, which we have recently strengthened to 1 in 725, with hydrochloric acid.

21,747. An acid solution of perchloride of mercury?—An acid solution, yes.

21,748. How do you apply it?—It is syringed on to the floor and walls of an infected house through the medium of wooden syringes. This is very freely done.

21,749. Is the syringing done on one or more occasions in any given house, or do you repeat it before the house is re-occupied?—Only once.

21,750. Do you think it necessary to include in disinfection the ceiling and every part of a chamber, or do you limit yourself to the floor and to a part of the wall?—As a matter of fact, when we are about it, we do the whole room, but I should be inclined to say that the floor and a very few feet of the walls was sufficient. At the same time, I think, from our present knowledge of plague that it would be a rather dangerous experiment to limit it to this. When one is about it, it is very easy to squirt everywhere.

21,751. Did you disinfect the articles in the chamber with the same chemical disinfectant?—That was always done by a steam-boiler—when the people were brought to the segregation camp. This was done away with in the segregation camp, and latterly we have been employing the railway disinfector—sending the people's clothing there.

21,752. Have you any distinct case in which clothing itself, apart from a living being, has communicated plague to a person?—The best example in my experience was the Karachi health camps in 1897. They had enormous health camps there. I think at one time there were something like 20,000 people in camp, and plague at that time in those camps was as bad as it was in some of the worst infected parts of a big town; in fact in one of the Karachi reports it was stated that there was hardly a hut that had not a case in it. After the disinfection of clothing was carried out, they came under the ordinary conditions of a health camp, that is to say cases did not develop in the camp after the incubation stage had elapsed.

21,753. The conditions in all other respects were the same?—Exactly the same.

21,754. How do you think the virus gets admission into the body?—I think it must be by inoculation.

21,755. That is so far as the skin surface is concerned?—I think, possibly, the tonsils may get inoculated also.

21,756. You think it may be introduced through a mucous surface as well as the skin surface?—Yes.

21,757. How do you think the virus penetrates to the skin surface; how does it reach the blood ultimately?—I could not give you an opinion on that. I have not been able to trace any local seat of inflammation, in the majority of cases.

21,758. Any lesion, or what?—Cracks or cuts in the feet of the natives. They are generally cracked, but I have rarely been able to trace any lesion or point of inoculation.

21,759. Have you any opinion as to whether the virus can pass through the unbroken skin or not?—Only purely negative ones—that one looks for these abrasions and one cannot find them.

21,760. You also think that it is absorbed by the tonsils?—I think it is physiologically probable.

21,761. Have you any case to justify that statement?—The infection of the cervical glands would possibly show infection through the mucous membrane of the tonsil.

21,762. The jaw glands, the parotid, and so on?—Yes.

21,763. Have you seen cases of that sort?—Yes, a great many.

21,764. Have you any evidence to show that it may be absorbed through the alimentary canal?—No

21,765. You have seen no such cases?—I may say I have not done much hospital work; my experience has been chiefly administrative.

21,766. Would you give us some account of what you consider a sufficient organisation for stamping out plague in a town?—We have in Poona a system of 12 or 13 Chief Volunteers, and we have had a surveillance system, and we have been able to treat each case of plague as it arises. Now that we have infection in a large block, we have had to increase our disinfecting parties. We had 10 soldiers employed as disinfectors, and six coolies from the Municipal authorities, for each party, and we formed 10 disinfecting parties, each party under a soldier. In that way one can work with a skeleton organisation, which can be readily increased if the disease was progressing.

21,767. What do you trust to in order to prevent the introduction of plague into a town, and to discover it when it has been introduced?—The first line of defence is by the rail—inspection at the railway station. An inspection of all passengers who arrive at Poona takes place there. Of course there are some who get out at some of the wayside stations and come in by road.

21,768. What is done with them if they are detected at the railway station?—If there is a rise of temperature they are sent to hospital.

21,769. For how long are they detained?—Until definite plague symptoms have developed. At the railway station the people who arrive in the town are placed under surveillance, which is done in this way, a certain number of volunteers, native gentlemen, vouch for people they know, respectable inhabitants of the town. A certain number of the arrivals have what we call "ward passes," which are passes given by the Superintendents of the divisions stating that the person is known, and resides in a certain house, and is going away for three or four days; and when he comes back again he produces this pass. He is then allowed out. There are a certain number of people who can give no fixed address, people coming to the city to work, and so on, and they deposit their baggage and bundles in a camp close by the station; these bundles are entered in a register, and then the people are allowed to go into the town. They are given the address of the Chief Volunteer of the division in which they are going to live, and as soon as they have intimated to him the house they wish to live in, they get a release ticket, and this is presented to the officer in charge of the railway camp, they are then released and placed under ten days' surveillance in the ward office of the Pet they are going to live in.

21,770. They have to report themselves?—Yes, every alternate day.

21,771. That is in order to get as early information of plague as possible, I suppose?—Yes.

21,772. Have you any other means of getting early information of plague?—Then we have sick certification, people have to report, or are supposed to report, all illnesses, and reports are recorded on a list.

21,773. When they report any sickness, what step is taken?—The medical officer on duty proceeds to the house to diagnose the case.

21,774. Are there any other steps that you take for getting early information regarding plague?—Finally, we have the system of corpse inspection. We have the volunteers, in conjunction with the census clerks, who keep up the census of the houses.

21,775. Is that census checked now?—Yes.

21,776. At what intervals?—Once a week.

21,777. What do you mean by corpse inspection; what does it cover?—It is really a death registration.

21,778. Every dead body is examined?—No dead body can be moved from a house until a certificate has been given by an inspecting medical officer.

21,779. All these measures are intended to give you early information?—Yes.

21,780. You consider that the most important information of all that you can obtain, I suppose?—Certainly.

21,781. And those measures which you have adopted, you have already told us, have been so far successful in preventing indigenous plague?—Yes.

21,782. (*Mr. Hewett.*) What population had you to deal with at Poona during the second epidemic?—From 60,000 to 80,000. I remember going into this question with Mr. Plunkett. He put it at 80,000. We thought it was less, but he, probably, had better information. That was his estimate at the time.

21,783. What is the population at the present moment?—It was taken about a month ago, and it was 130,000.

21,784. That is a good deal above the normal?—Yes, it is 12,000 above the normal.

21,785. Has the mortality been above the normal during the last three months?—Yes.

21,786. Higher than you would expect from the increase of population?—Yes.

21,787. How do you account for that?—We have an influenzal epidemic and also measles, and whooping cough, which cause a large mortality, particularly amongst infant life, and there is no doubt that the influenzal influence is causing mortality among aged people.

21,788. Dr. Venis put before us yesterday a statement of the system of corpse inspection up to the 31st December last. (*See* Question No. 21,416.) Have you got it for a later date?—Yes. (The following statements for the whole of January 1899 were supplied by the Witness subsequently:—

Corpse Inspection, January 1899.

1st	5		
2nd	8		
3rd	18		
4th	11	Total for 1st week	65
5th	6		
6th	8		
7th	9		
8th	9		
9th	11		
10th	19		
11th	11	Total for 2nd week	99
12th	16		
13th	18		
14th	15		
15th	14		
16th	9		
17th	9		
18th	13	Total for 3rd week	85
19th	16		
20th	14		
21st	10		
22nd	13		
23rd	10		
24th	22		
25th	15	Total for 4th week	92
26th	10		
27th	8		
28th	14		
29th	9		
30th	17	Total for last three days	44
31st	18		
Total	385		385

Mortality according to Age.

Under 1 Year.	From 1 to 5 Years.	From 5 to 15 Years.	From 15 to 30 Years.	From 30 to 60 Years.	Above 60 Years.
118	90	12	48	53	64

N.B.—The mortality in children under five years of age is striking, viz., 208, and may in all probability be due to the extremes of temperature that prevailed during this month. In January 1896, the year taken for comparison; the total under this head was 59.

Causes of Death.

I.—Puerperal diseases	10
II.—Senile decay	13
III.—Stillborn children	24
IV.—Inanition and marasmus	39
V.—Whooping cough	11
VI.—Measles	8
VII.—Tuberculosis (including phthisis)	28
VIII.—Convulsions	12
IX.—Diarrhœa (including enteritis)	46
X.—Dysentery	5
XI.—Accidents (including burns, drowning, &c.)	7
XII.—Hydrophobia	2
XIII.—Syphilis	3
XIV.—Leprosy	1
XV.—Disease of heart	6
XVI.—Malaria and other fevers	12
XVII.—Brain diseases	3
XVIII.—Ill-defined causes (including jaundice, abscess, &c.)	14
XIX.—Malignant disease (cancer)	2
XX.—Broncho-pneumonia	40
XXI.—Bronchitis	78
XXII.—Lobar pneumonia	15
XXIII.—Diphtheria	1
XXIV.—Kidney disease	5
Grand Total	385

Mortality for the Month of January.

1896	259
1897	250
1898	497
1899	385

N.B.—In the years previous to 1899, the still births are not included.)

21,789. Can you tell us how many deaths there were during January?—385.

21,790. How many of those were put down to influenza?—There are 40 bronchial pneumonia and 78 bronchitis; and there are 15 lobar pneumonia—all influences of the influenzal prevalence.

21,791. Were there any cases in which the cause of death was not determined during the month of January?—They are all under certain headings.

21,792. There is a heading "Unknown" in the list by Dr. Venis. Was there any similar heading in January?—They are "Ill-defined causes, 14."

21,793. That is a new heading?—Yes.

21,794. You have not got this item "Unknown" in January?—No; they are "Ill-defined causes."

21,795. Was there plague in the villages in the neighbourhood of Poona at this time?—Yes, in January.

21,796. I understood you to say that you did not believe in a local recrudescence?—I have had no experience of it, and I am inclined not to believe in it.

21,797. You made a reference in your précis of evidence to the second outbreak at Karachi having been possibly due to local recrudescence. Do you withdraw that now?—I must say from my experience now, that, if we were going to have a recrudescence here, we would have had it by this time.

21,798. Do you find that the cases which have occurred in the last few days in Poona have occurred either in the houses which were previously infected, or in the neighbourhood of houses which were infected in the previous epidemic?—This I have not ascertained.

21,799. Do you consider that the system which you have now of surveillance of passengers by rail and road is the maximum of interference which can be legitimately taken with the movements of the people?—Is it effective in preventing people whom you wish to control from getting into the town without observation?—Up to now I can say it has been efficient.

21,800. You would not advocate any further restriction with the movements of the people?—No, I should not.

21,801. You have not had a general evacuation of Poona?—No, only in isolated blocks.

21,802. Do you think that it would be feasible as a compulsory measure to have a general evacuation of a town of the size of Poona?—Anything, of course, is possible.

21,803. I mean with an efficient control over the inhabitants of the place?—It is entirely a matter

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of money. A town can be moved if the money is forthcoming.

21,804. Would you not require an enormous force to control the evacuated inhabitants?—I should think it would be practically impossible.

21,805. If you attempt to completely evacuate a large town, would the probable result be that you would scatter plague cases all over the country?—I think it is very likely.

21,806. When you have plague in a village, do you think there is the same objection to evacuate the whole of it as there is in the case of a large town?—No, I do not.

21,807. Are the villagers accustomed to camp out in their fields?—Yes.

21,808. Do you think that the villagers of an agricultural village are likely to go moving about the country because they were camped out owing to plague?—I do not think so. I think the agriculturists will still stay by their villages.

21,809. The majority of villagers who are agriculturists are wrapped up in their village site, and having no business elsewhere, would not be likely to go away?—Yes; but that is not applicable to all villages.

21,810. You have villages in which the population are more like the population in a town in this respect,—that they are more accustomed to moving about over a larger area?—Yes.

21,811. Do you think that voluntary evacuation in such villages as those is likely to lead to plague spreading about from place to place?—I think so, undoubtedly.

21,812. Would you ever allow home segregation—in Poona, for instance?—It has never been allowed.

21,813. Would you allow it?—I should be sorry to say what I would not be prepared to allow in plague. One gets new ideas every week in plague.

21,814. Do you think that it would be impossible to allow a patient to remain in his own house, provided that is suitable, and that he can be isolated, and properly attended in it?—This is supposition. I think it is possible that it might be done. I am only presuming that certain conditions were followed.

21,815. Would you please specify the conditions?—The strictest disinfection of floors. You would have to evacuate the house while the disinfection was going on. In double-storeyed houses, I should be very sorry to say one way or the other.

21,816. You have formed no definite opinion against house segregation under such conditions?—I have not.

21,817. What arrangements do you now make as regards segregation of the other inhabitants of a house when you take a patient to hospital?—They are sent to the segregation camp; it is really a surveillance camp; it is not close segregation.

21,818. How long are they kept there?—10 days.

21,819. During those 10 days are they permitted to re-visit the house in which a case of plague has occurred?—The house is immediately disinfected and thrown open. As soon as it is dry it can be re-occupied.

21,820. They may be there during the day, but not during the night?—That is so. They sleep in the camp for the first four days.

21,821. Do you disinfect all the houses in the neighbourhood of a house in which plague now occurs?—No.

21,822. You do not consider that to be necessary?—I may say, with regard to this recent outbreak, that I was under the impression that it might be due to some rat agency. I do not think so now, in fact, I am sure that it is not. I thought that there might have been some universal floor-infection by rats. We commenced a modified sort of evacuation; but now each house is being treated in the ordinary way. In the case of a death from plague the house is evacuated and disinfected.

21,823. Does the system now in force in Poona, as regards the treatment of the patient, the treatment of the other inmates of the house, and the disinfection of the house, represent your mature experience as to the best way of dealing with a large outbreak in a town?—Yes.

21,824. Do you find any objection on the part of the people here to corpse inspection?—No, none.

21,825. If you have any specific instance, perhaps you will tell us?—The only specific instance brought to my notice was with regard to the inspection of the corpse of a fakir. It was brought to our notice by one of the Chief Volunteers of a Pet who said that the man was of holy habits and an ascetic, and that the people did not wish his corpse to be handled by an European doctor. We assented, and said that they might have a Brahman doctor, the European doctor being present. There was no difficulty about it. There was also one objection from a Muhammadan, but that was easily got over. The corpse was allowed to be inspected.

21,826. Have you any system of pardah among the Hindus here?—No, none to my knowledge—not in Poona city.

21,827. Is there a Muhammadan population among whom the pardah system prevails largely?—I should say not.

21,828. Is it an influential one compared with the Hindu population, and compared with the Muhammadan population of other places?—The Muhammadan population is about 15,000.

21,829. That is, relatively, very small, is it not?—Relatively small to the other inhabitants.

21,830. Is the Muhammadan population, as compared with the Muhammadans in other places, a highly important population?—There is a large community of Borahs, numbering about 1,000. I should not say that there is the same number of educated people amongst the Muhammadan population here as there are amongst the Hindus, in fact, I am sure there is not.

21,831. Would you consider that the Muhammadans have the same influence and importance in the city of Poona as they have in some of the more important cities of the Punjab and North-Western Provinces?—I have no data upon which I can give an opinion.

21,832. A statement appears in the first few lines of your précis with regard to the number of cases of plague which occurred in the health camp during the second epidemic?—Some 4,800 persons were sent to the health camp at Bhamburda from infected parts of the city. I say in my précis that out of this number only three cases of plague occurred. I ought to have said that out of this number only one case of plague occurred. I have that from the records of the General Plague Hospital.

21,833. Have you any figures as regards railway and segregation camps since the late Mr. Rand's report*?—There is the report on the railway detention camp by the Superintendent who was there.

21,834. Could you give us similar figures to show how many persons went into the railway detention camp, and how many cases of plague developed there?—The total number of contacts segregated in Sawar's Gate Camp was 13,213, and there were 146 cases of plague. In the Station Camp there were 13,670 persons detained and 23 cases of plague occurred. Nine deaths, not from plague, occurred in camp.

(The following facts appear from the report of the superintendent of the railway detention camp referred to in the previous question, which is not reprinted with the Proceedings of the Commission. The camp, to which the report relates, was opened on the 13th of February 1898, and the report gives figures regarding it up to the 20th May 1898, when only 47 inmates remained. These figures are as follows:—

For the Week ending Friday	No. of Persons detained.	No. of Persons discharged.	Balance.	No. of Cases of Plague detected in the Camp.
1898.				
February 18th	192	8	184	0
„ 25th	270	155	299	0
March 4th	588	244	643	0
„ 11th	795	505	933	5
„ 18th	941	708	1,166	2
„ 25th	644	942	868	1
April 1st	1,173	721	1,320	4
„ 8th	1,900	1,055	2,165	3
„ 15th	1,534	2,698	1,001	4
„ 22nd	1,302	881	1,422	1
„ 29th	1,525	1,351	1,596	1
May 6th	2,153	1,388	2,361	1
„ 13th	589	2,801	149	1
„ 20th	64	166	47	0
Total -	13,670	13,623	47	23

* Printed on pp. 301 to 357, Vol. II. of "The Plague in India, 1896–97," by R. Nathan, I.C.S.

Of the 23 cases of plague, 2 were discovered on the 5th day after the patients entered the camp, 1 each on the 6th and 8th day, and 2 on the 9th day. It is probable that most of these patients were ill before their sickness was discovered. Of the *détenus* 8,450 came from Bombay, and 5,220 from other places; they were grouped in the camp by castes, but there was no special grouping of persons according to the place they came from; and though cases from elsewhere were taken out of the trains, only persons from Bombay became sick of plague while in the camp. It is therefore probable that the persons who developed plague after a stay in camp of 5 days or more, did not acquire their infection in the camp.)

21,835. Can you give us any information which would bear upon the period of incubation? Can you tell us, day by day, how many cases developed, and, if there was a prolonged period of incubation in any case, state whether it was due to re-contact or not?—The following statement shows the period of incubation:—

Plague occurred within	24	hours	in	21	cases.	
,,	,,	after	1	day	,, 20	,,
,,	,,	,,	2	days	,, 17	,,
,,	,,	,,	3	,,	,, 22	,,
,,	,,	,,	4	,,	,, 22	,,
,,	,,	,,	5	,,	,, 15	,,
,,	,,	,,	6	,,	,, 7	,,
,,	,,	,,	7	,,	,, 6	,,
,,	,,	,,	8	,,	,, 8	,,
,,	,,	,,	9	,,	,, 2	,,
,,	,,	,,	10	,,	,, 2	,,
,,	,,	,,	11	,,	,, 2	,,
,,	,,	,,	12	,,	,, 1	,,
,,	,,	,,	13	,,	,, 1	,,

The last two cases were due to the patients being kept under observation for a few days before a definite diagnosis of plague was arrived at.

21,836. Have you had any instance where plague has moved to a house adjoining an infected house without any means of communication between them, and without any apparent communication between the residents of the two houses?—I cannot say that, unless one could eliminate all human means of intercourse. I have never been able to do that.

21,837. Although you have an open mind as regards the communication by rats, you do not think that other animals communicate the disease?—I cannot answer that.

21,838. Do you know whether there was any Health Officer here when plague broke out in the first epidemic?—Yes.

21,839. Do you know what qualifications he had?—He was a Parsee gentleman, an L.R.C.P., of Edinburgh.

21,840. Is there a Health Officer now?—Yes.

21,841. Who is he?—Dr. Dantes, a Goanese.

21,842. Do you know anything of the ordinary powers of the Health Officer?—The powers of the Health Officer have practically been absorbed by the Plague Committee.

21,843. Have you as the Executive Officer in charge of plague operations here rather larger powers than the Health Officer?—Very much larger.

21,844. Do you think that it is necessary under ordinary circumstances that the Health Officer should have as large powers as you have now?—No, I do not.

21,845. Do you think that it is necessary in ordinary times that the Health Officer should have more enlarged powers than he already has?—Yes. I think the Health Officer would find it rather hard to define his own powers here.

21,846. Would it not be desirable that his powers should be strictly defined?—I think so.

21,847. Do you know whether there was any byelaw as to the registration of deaths in Poona at the time when plague originally broke out?—I could not say.

21,848. Do you think that in a Municipality such as Poona there should be a byelaw requiring the registration of deaths under ordinary circumstances?—Undoubtedly.

21,849. Do you think that there would be any difficulty in rigidly enforcing such a byelaw, provided that the Health Officer's authority was properly maintained?—I do not think that there would be.

21,850. Do you think that it would be easy to enforce such a byelaw provided the Health Officer had no more authority than he had under ordinary circumstances—than he had at present?—I think it might be enforced.

21,851. Is it your opinion that there is any measure which is more urgently required in connection with the suppression of the plague than some system for securing the accurate and early notification of cases of death of all kinds in the larger cities?—Early notification is the most important measure to enforce from a plague point of view.

21,852. Have you had any experience in rural areas?—I have been in charge of this district for the last seven months.

21,853. Do you regard it as desirable to endeavour to secure early and accurate notification in rural areas as well?—I think it is, but less important than in towns.

21,854. Do you think it would be very difficult to secure such notification in rural areas under ordinary conditions, at all events during the next few years?—As a routine system I think it would be extremely hard to get a reliable return.

21,855. Do you think that it would be possible in a large Municipality like Poona to have a byelaw which would require that cases of epidemic disease should be reported under ordinary circumstances?—I think it is a most advisable law; but it would be impossible to carry it out in India. You mean the same notifications of contagious diseases as in England?

21,856. Quite so. First of all notification of sickness, then notification of death. You agree that notification of death could be insisted on. I want to know whether you think that a similar byelaw requiring notification of epidemic sickness could be carried out?—It is not possible here, not in the present state of things, where 90 per cent. of the people die without being seen by a doctor.

21,857. (*Mr. Cumine.*) Do you consider that the measures in the second epidemic were materially different from the measures in the first epidemic?—Yes.

21,858. It seems that the first epidemic lasted from five to six months, and had a climax of 453 attacks; and that the second epidemic lasted six or seven months, and had a climax of 420 attacks. Can you point to any material difference between the course of the two epidemics? Can you tell us to what extent the modification of the measures in the second epidemic made the second epidemic run a different course from the first epidemic, made it cease sooner, or made it produce fewer attacks? I want to see to what extent the difference in measures produced a difference in the course of the epidemic. You say the measures differed materially in the second epidemic from those in the first. Did the course of the second epidemic differ from the course of the first? Did the change of the measures in the second epidemic produce a difference in the course of the epidemic?—I cannot say. I do not think I have compared the charts.

21,859. Dr. Venis gave a table of statistics on corpse inspection. Does the number in his table mean the number of corpses that were inspected, or does it mean the number of corpses the inspection of which revealed the cause of death—the number of cases in which the cause of death was not known until the actual inspection of the dead bodies? Which does it mean?—His table shows cases that have been inspected by a medical officer during his corpse inspection of the city.

21,860. It merely means the number of dead bodies that have been looked at?—Quite so.

21,861. It does not mean the number of dead bodies whose cause of death has been ascertained purely and solely by looking at the corpse itself?—It means every case that died out of hospital.

21,862. Would it be possible to tell us to what extent in the case of the corpses in this table the cause of death was ascertained by the inspection of the corpse

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and the inspection of the corpse alone, without having seen the patient before death, and without having had any history of the patient's illness? For instance, I find heart disease put down there. Could you tell, by inspecting the body of a person who died from heart disease, that heart disease was the cause of death?—No, certainly not.

21,863. That would be one case in which corpse inspection would not in any way assist in discovering the cause of death?—That is so.

21,864. Could you tell us whether, amongst these corpses, there are any corpses in which the cause of death (including plague) was discovered by corpse inspection alone?—Yes.

21,865. I want to see what the value of corpse inspection is when you have corpse inspection alone. Supposing you found a body lying on the road with nobody near, and nobody to tell you the history of the case, and you had nothing to look at but the body alone, that would be an instance where corpse inspection was the only thing you had to enable you to find out the cause of death. After eliminating all cases where you had other things to help you, how many cases will remain in this table where you had nothing but the view of the body itself to enable you to tell what the cause of death was?—We know that 85 per cent. of the cases of plague died of bubonic plague, which is an objective feature in a corpse.

21,866. Are not buboes sometimes absorbed immediately before, or immediately after death?—I have never heard of a case. It is not my experience.

21,867. In the case of a certain number of people who die of plague, it is possible to tell from the circumstances and surroundings that they died of plague, is it not?—Yes.

21,868. For instance, if two people died in this room yesterday, and a third person dies to-day, would not that fact of itself, without examining for buboes, be enough to make you assume that the person died of plague?—One would be extremely suspicious that it was so, there being two cases in one house.

21,869. You have only had two or three objections made to the examination of corpses, but have you had any complaints from people saying that corpses have lain for a very long time in their houses because the medical officer has not come to examine them?—Yes.

21,870. How many such cases, roughly, have you had?—I have certainly had two or three complaints. In the volunteer meetings that have been held that point has come up for discussion. There have undoubtedly been two or three complaints made in that way, but very few written ones.

21,871. There have been undoubtedly complaints of what?—That a delay has occurred.

21,872. (*Prof. Wright.*) You receive information of sickness in the town by reports, do you not?—Yes.

21,873. These reports come to you from doctors practising in the town?—Yes.

21,874. And from volunteers?—Yes.

21,875. And, further, from the relatives of the patient?—Yes.

21,876. Would you tell us what percentage of reports come from the relatives of patients?—I am afraid I do not know that.

21,877. Could you prepare a table and give your sources of information?—There were 2,863 cases reported altogether.

21,878. During what period?—12 months.

21,879. For 12 months, 1898, the number of cases given in the table prepared by Dr. Venis as certificated is 1,891?—Those are by volunteers, doctors, and relatives.

21,880. Was this table prepared under your supervision?—Yes; but I have not looked over the figures recently.

21,881. Am I right in saying that a very few cases were reported by the relatives of the patients?—I should not like to say what the percentage was.

21,882. Have you an impression as to whether few or many were reported by the relatives of the patients?—I should say a great number.

21,883. Out of those 1,891, how many were reported to you by the relatives of the patients, how many by doctors, and how many by your volunteer committee?—(The following figures were supplied later by the witness:—)

There were reported by relatives	-	402
,, ,, ,, doctors	-	54
,, ,, ,, volunteers	-	1,435
		1,891

21,884. What penalty was there for not reporting?—The penalty has varied very considerably. The penalty used to be that the people were put into the segregation camp or under surveillance. Practically, however, we have never, or very rarely, exacted the penalty within the last three months. We wish to diminish all motive for not reporting or concealment of any sort.

21,885. But the exaction of a penalty is a motive for reporting cases, and a remission of the penalty is a motive for concealing cases, is it not?—I suppose it is.

21,886. How many cases of sickness do you think escape detection in Poona in a year?—I do not know.

21,887. How many unreported cases of sickness, do you think, occur in a year in Poona city? I make out that 1,900 cases were reported to you, and of those 600 died. That is a proportion of one case of death to three cases of sickness. With your total of 3,000 deaths, I take it that you would have 9,000 cases of sickness. Am I right in that?—Yes.

21,888. How many cases of plague were detected during life, during 1898, by means of the visitation of the sick? Am I right in saying that there were 25?—Twenty-one by visitation of sick, from May 1898 to January 1899.

21,889. What object was achieved by the detection of those 21 cases in life?—To get the case early—to take early measures. The sooner you get an infected unit the less likely he is to spread infection.

21,890. Were these 21 cases removed to hospital; you did not, did you, bring them all to the hospital?—They were brought to hospital.

21,891. What is the advantage you are going to obtain from your sick inspections in the future? I understand that you are going to leave moribund patients in their houses?—None of the cases detected from May 1898 to January 1899 were moribund.

21,892. A large number of the cases which you will detect by your sick inspection will be moribund cases, and, therefore, you will leave a large majority of the plague patients whom you discover in their houses?—Arguing from our previous experience I should say not. This system has not been tried.

21,893. And you propose to isolate certain other plague patients in their own houses?—No, I am prepared try it.

21,894. Those, also, you propose to leave in their houses?—No.

21,895. And, again, certain of the plague cases which you detect will come under the category of suspicious cases?—Yes.

21,896. Those, also, you will be compelled, will you not, to leave behind in their houses?—We have an Observation Hospital.

21,897. Will you take these merely suspicious cases away from their houses?—It is not an absolute rule about people being treated in their own houses. Each house will be treated on its own merits. We will take into consideration whether it is a suitable house for a patient to be treated in, or not.

21,898. The point that strikes me is this. There are very few cases detected during life and most of these you will be compelled to leave in their quarters for one reason or another. You will leave them behind, either because the diagnosis is not certain, or because the house is good enough to permit of the treatment of the sick in it, or, lastly, you will have to leave your plague patients in their houses because they are already moribund when you find them. In view of these facts I want to learn what advantage will accrue from your system of sick visitation?—Up to date no trial has been made of treating patients in their own houses, and out of 25 cases which occurred during 1898, 23 were seen during life and all were sent to hospital. One advantage will be that in a large town we hope to diminish panic.

21,899. How can you diminish panic by going to see sick persons in their houses?—By allowing certain cases to be treated in their houses.

21,900. I am not doubting the wisdom of your plague policy; I want merely to learn how you are advantaged by finding a plague patient while he is alive, if you have, from one cause or another, to leave that plague patient in his own house?—By antiseptic precautions the conditions existing in hospital might be approximated.

21,901. (*Mr. Hewett.*) In these cases in which plague was detected during lifetime, would it not be an advantage that you would also find the contacts?—Yes, undoubtedly.

21,902. (*Prof. Wright.*) I will now go to corpse inspection. You have a table here (see Questions No. 21,416 and 21,788) in which deaths are classified according to causes; is there any one of these diseases, with the exception of plague, which is enumerated in that table, which can be detected by mere inspection of the corpse?—As vital statistics, I do not think the table is worth anything. Cholera, small pox, and leprosy, are diseases which could be diagnosed after death.

21,903. Why are the cases not classified simply under the headings of "plague" and "not plague"?—It is the nearest approach that one can get to some sort of registration. We tried to get it in that way—we were only concerned with plague. There was no particular reason why we adopted this course. At first we commenced with "plague" and "not plague."

21,904. On what principle is a person put down as dying from asthma or bronchial pneumonia?—I admit that the table is of no value from a vital statistical point of view; it is the best approximation to accuracy.

21,905. What is the best you can arrive at in the matter of a determination of the cause of death? Can you arrive at anything more than a classification of deaths into a class of "certainly plague," "certainly not plague," and "suspicious"; is not that the most important classification which can be based upon corpse inspection?—Practically that is all, except cholera, small pox, and leprosy.

21,906. With regard to these cases, when you classify a case as "due to plague," I presume that this will happen only when a corpse is found to have buboes?—Yes.

21,907. Further, I presume, that if a corpse has no buboes, you put that down as "suspicious," whenever you find that another death has occurred in the same house?—Yes.

21,908. And if you find a case of sudden death, you put that down also as "suspicious"?—Yes.

21,909. If you find that a body is well-nourished and that the period of illness has been very short, you also put down that case as "suspicious"?—Yes.

21,910. And if, further, you see that the tongue is furred like a plague tongue, and if you see that the conjunctivæ are injected, you would put that down as "suspicious"?—Yes.

21,911. So that you would have quite a large number of cases which you would classify as "suspicious"?—Yes.

21,912. With regard to disinfection, you would disinfect, would you not, all the houses where deaths had occurred which were certainly due to plague?—Yes.

21,913. What would you do with houses in which suspicious deaths had occurred, would you disinfect these houses also?—We have done so up to now.

21,914. I find that in certain months, for instance, in November and December last, no plague cases were detected in Poona; that means, I presume, that no corpses with buboes were detected? But there may have been suspicious cases, may there not, in those months?—Yes.

21,915. Was disinfection carried on all through November and December, or was disinfection suspended?—Instructions were given to the Inspecting Medical Officer that in all suspicious cases the certificates were to be marked "suspicious," and they were treated as plague cases. With regard to the measures taken, the place was disinfected and the people were placed under surveillance.

21,916. Did suspicious cases occur right throughout or was there any month in which no suspicious cases occurred?—We have been getting a large number of cases the last few months.

21,917. Was there any month in which you had not suspicious cases, any month in which you can assert that there was no plague in Poona?—I could not say.

21,918. We have, for instance, a great number of cases of bronchial pneumonia and bronchitis set down for the months of November and December, and I understand that there were such deaths in January?—Yes.

21,919. Were all these suspicious cases from your point of view?—Yes.

21,920. Was disinfection carried out in all those cases?—In every case marked.

21,921. In view of the fact that a large number of cases can only be classified as "suspicious," and in view of the fact that you cannot in these cases arrive at a definite opinion as to whether you are or are not dealing with plague, do you not think that corpse inspection, as at present carried out, is unsatisfactory?—No, I do not think it is.

21,922. I presume you can never, by your present methods, certify the town to be free from plague?—I think you may arrive at it by bacteriological examination.

21,923. Do you think that corpse inspection ought to be supplemented by bacteriological examination of the the suspicious corpses?—Yes.

21,924. Have you any means of supplementing your corpse inspection by bacteriological examination?—No, not in Poona.

21,925. Have you represented the great importance of such a bacteriological examination of all the suspicious cases?—We sent down to Bombay to have some examined.

21,926. Do you know how many specimens derived from corpses were sent down to Bombay?—Seven altogether.

21,927. Do you not think that there would be a great advantage in having the bacteriological examinations done here?—Yes.

21,928. And, further, that it would be a great advantage to have these bacteriological examinations made in all suspicious cases?—Yes.

21,929. Do you think that corpse inspection, combined with the bacteriological examination of suspicious cases, would be the most valuable agency that could be employed in detecting plague?—Yes. I think it would diminish the necessity for our measures of disinfection which we have to take now.

21,930. I understand you have to waste a lot of disinfectant now simply because you do not know whether suspicious cases are really cases of plague or not?—We disinfect the houses almost immediately, and we put the inmates under surveillance. Directly the diagnosis is cleared up, and we know that the case is not one of plague, they are no longer put under surveillance.

21,931. You think that you might stop disinfecting operations altogether as soon as bacteriological examination showed that no more cases of plague were occurring in the town?—Undoubtedly.

21,932. (*Mr. Cumine.*) With regard to the present infection of Poona, was not the mischief done before you ever saw the corpse at all? Was not Poona infected before the man died?—Yes.

21,933. In this case the damage was done before the man was a corpse?—I have admitted that you could not repair that particular damage by the system we have now.

21,934. (*Prof. Wright.*) But the fact that this case of plague was detected immediately after the man died is evidence, is it not, of the utility of your system of corpse inspection?—Yes.

21,935. (*The President.*) What is the largest number of people you have evacuated in Poona at one time?—We evacuated 4,800 people into the health camp at Bhamburda.

21,936. What is the largest number of people you have had evacuated in one given time?—962 was the maximum.

21,937. I do not understand your views about home segregation. I thought you said that it was attended

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with very considerable risk?—We have never tried home segregation. I said one did not know what minimum one might eventually come to with regard to segregation. It is a system of which I have had no experience. One is prepared with plague, however, to have an open mind with regard to any particular measure.

21,938. You think there are so many risks that the experiment would be unadvisable unless you had some further experience?—Quite so.

21,939. Do I understand that your plague cases are not being treated at home at the present moment?—Home treatment is on its trial.

21,940. What are you doing?—The regulation passed recently on the subject was to the effect that cases which were reported early, and were found to be in airy houses, would be allowed to be treated in their own homes.

21,941. Are there not the same risks, or nearly the same risks, in that measure as there would be in home segregation?—There is risk to the attendant or relative, undoubtedly. One tries to diminish that by putting disinfectants freely on the floors.

21,942. Is there a risk of outside conveyance by friends?—There is a possibility of it, but from one's experience in Plague Hospitals I do not think it is very great.

21,943. I do not refer to Plague Hospitals; I refer to houses in the centre of the town where a plague patient is being treated. Are there not great risks of infection being conveyed outside that house, which you cannot keep under control in the same manner as a Plague Hospital, where friends come in and friends go out? Have you had much experience of this treatment?—It is on its trial. That is the regulation now in force, and we are waiting results.

21,944. With reference to the registration of deaths, I think you said you considered that that was a very important measure, and should be carried out effectively; that you should have an improved system of registration of deaths so as to obtain early information of the cause of death. Is that not so?—Undoubtedly.

21,945. You said that that was the greatest requirement at the present time?—Undoubtedly.

21,946. With regard to what?—Plague, and epidemic diseases generally.

21,947. What do you say now with regard to sanitary measures? How far would your opinion be modified if you also took into consideration sanitary measures and their influence in reducing the likelihood of epidemic diseases?—I think they have much greater influence in some diseases than in others.

21,948. With regard to generally prevalent diseases, sanitation takes an important place?—With regard to plague, and such diseases, I think it has a very vast influence; but with regard to small-pox, and so on, I do not think it has the same influence.

(Witness withdrew.)

Capt. C. K Morgan, R.A.M.C.

Captain C. K. MORGAN, R.A.M.C., called and examined.

21,949. (*The President.*) You are in the Royal Army Medical Corps?—Yes.

21,950. (*Prof. Wright.*) How long have you been on plague duty?—About two years.

21,951. Have you any information with regard to the occurrence of neuralgia in people who are engaged in plague work, and in Medical Officers who are attending on plague patients?—Yes; in Poona, about the middle of the epidemic of 1897-98 my attention was first drawn, I think by Colonel Fawcett, to neuralgic pains in the glandular regions occurring in those doing plague duty. I inquired of the other officers, and also of the soldiers, and the majority of them admitted that they suffered from the same symptoms. They had neuralgic pains in the glandular regions of the body, in the arm, groin, and in the neck.

21,952. Have you seen any cases in which these neuralgic pains were severe?—Yes, they were very severe in several cases. I am not quite certain, but I think two or three cases went to hospital complaining of the pain.

21,953. Do people who have been a long time on plague work cease to suffer from these pains?—They do not. I have been for two years amongst the plague, and I still have them.

21,954. If you cease to do plague work for a time and then go back to it, do the pains return?—Yes, they come again when one sees patients.

21,955. Does the seeing of a single case of plague suffice to cause the reappearance of the neuralgics?—Yes, when I have seen only one case in a day I have had those neuralgic pains.

21,956. Do you think any element of hypochondriasis can contribute to the causation of these pains?—It may be so, but they are very general.

21,957. Have you heard of the occurrence of these pains among soldiers who knew nothing about pathology?—Yes, they did not generally complain of it, but admitted it when I asked them.

21,958. With regard to corpse inspection, do you think that, in a great number of instances, it is difficult to detect cases of plague by mere inspection of the corpse?—In many cases it is extremely difficult, in fact impossible.

21,959. Have you found in the course of your sick-visitation that it is often very difficult to diagnose a case of plague?—Yes, it is impossible in many cases.

21,960. Do you think bacteriological examination would help you very much in that which you diagnose?—Yes, very materially.

21,961. Have you seen cases resembling mumps which seemed to you to be possible cases of plague?—Yes.

21,962. Have you seen any cases of *pestis ambulans?* I mean cases of swollen glands unaccompanied by serious symptoms which are seen in plague?—Yes, I think I can recall a very small number of cases, in fact only two.

21,963. (*Mr. Cumine.*) You get a history of the case from the friends of the patient, do you not?—Yes, but they give very erroneous statements. We had a case yesterday where we were told that a child had had dysentery for fifteen days. The child was far too well nourished for that to have been the case, and it was put down as a suspicious case of plague.

21,964. (*The President.*) You have always an opportunity of learning the patient's history from friends or outsiders?—We get very erroneous information from them.

21,965. Still, you have an opportunity of examining them and asking them questions?—Invariably.

21,966. Your opinion is not arrived at by inspection?—No, not by inspection alone.

(Witness withdrew.)

Lieut.-Col. W. J. Fawcett, R.A.M.C.

Lieut.-Colonel W. J. FAWCETT, R.A.M.C., recalled and further examined.

21,967. (*Prof. Wright.*) Can you tell us something about the neuralgias which develop in medical officers and men who are engaged in plague work?—I presume you allude to what one may call plague neuralgia. I think I first observed it in Poona in the latter part of 1897. Probably the best way of describing the affection is by giving the details of a case. I came across a very well marked case, perhaps one of the most severe, in an officer whose duties did not always bring him in contact with plague, but sometimes for days together he had occasion to be in contact with plague cases and handle them. On each occasion that he handled a plague case, within half an hour afterwards, he had symptoms exactly similar to those which follow the immersion of one's hands in carbolic acid solution, a tingling in the hands extending over the lymphatics of the forearm and before many minutes reaching the lymphatic glands in the axilla. Sometimes it passed off after a few hours, at other times the pains were intensified until the lymphatics felt like burning cords, and the glands in the axilla became extremely painful—a neuralgic pain not increased on pressure. At other

times there were very violent neuralgic pains in the lymphatic glands in the back of the neck, so violent that they quite prevented rest and sleep. This officer never had neuralgia of any kind or description before or since. When I first became aware of this case it led me to inquire among other officers, and I found one medical officer who described of his own accord exactly similar symptoms in himself. At least one Captain and one subaltern on plague duty in the cantonment suffered in the same way. The subaltern suffered aching pains in the groin for the first 10 days after he went on plague duty. He had been on plague duty in two or three different places in India. He had sought relief in remedies of various kinds, but without the slightest result. I did not like to suggest these symptoms to the men, so I asked the medical officers in charge of the two camps, and they told me they frequently had men coming in sick complaining of neuralgia. Two of those men were so bad that they were sent to the Station Hospital. There I observed them, and I have not the slightest doubt that they were suffering from an exactly similar disease. I should like to say that this plague neuralgia is alluded to in print in a popular lecture of mine dated 19th January 1898.

21,968. Will you read us the paragraph?—"I have "found that of those Europeans who have been most "exposed to plague, many have told me that during "the first week or so of their exposure they suffered "from neuralgic pains and stiffness in the groins, "armpits and neck."

21,969. Have you suffered from it yourself?—Yes.

21,970. When you go away from plague work do the pains cease?—Yes. They never last more than a few hours at a time. Many of the officers told me that they became immune after some days. I never did, because my work was not continuous. I frequently did not handle a plague case for two or three weeks, and then mixed with them again during the following two or three weeks. Then I always got the pains again. In fact, so accurate was it, that I used it as a means of diagnosis.

21,971. (*The President.*) Do you mean you could apply this power any time you wished?—Not in every case. I was alluding specially to the first case of plague in a European soldier which occurred in the cantonments. It was a doubtful case, and I examined him with great care, and spent some time in the ward with him. When I reached home I found the tingling had set in in my hand. That was within half an hour. I happened to meet the man who was attending on the patient and I said, "That is undoubtedly a plague case." A bacteriological examination of the bubo made that afternoon confirmed the fact that it was a case of plague. We went back again in the afternoon and he had all the usual symptoms of plague.

Lieut.Col. W. J. Fawcett, R.A.M.C.

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21,972. Did you have a similar experience in other cases?—That was almost the last in the cantonment. I noticed it in one or two other cases. I undoubtedly used it as a means of diagnosis in suspicious cases.

21,973. Have you done so lately?—No.

21,974. Would it not be advisable to take an opportunity of doing so?—I do not desire to suffer from neuralgia of that kind again. The power does not last for very long. It would very soon be blunted.

21,975. (*Prof. Wright.*) You said you would make some inquiries with regard to the statistics of the inoculations which were done at Kirki?—I regret to say that although I hold a receipt for a bundle of papers, of which this was one, in the Assistant-Adjutant-General's Office in the Poona district, they are not to be found, but inquiries are being made. Perhaps the Commission might apply to the Assistant-Adjutant-General.

21,976. Before you gave up these reports of the result of the inoculations, had you made a careful study of them?—Yes, and I considered them so untrustworthy that I was unable to draw any inference of any value, or I would have had great pleasure in bringing them to the notice of my superiors at an early date.

21,977. Do you know if a special report other than this untrustworthy report that you speak of was sent to Professor Haffkine with respect to the result of the inoculations?—This was not submitted to Professor Haffkine; it never went further than myself.

21,978. Had Professor Haffkine a special report on the result of the inoculation?—Yes, by another medical officer.

21,979. Do you think the report of the medical officer in question was based on these statistics which you speak of as untrustworthy?—I do not know; I rather think not.

21,980. Were there two medical officers on the spot, one who made the statistics which were submitted to you and another who made a report for Professor Haffkine?—I believe a medical man came down here specially to make a report for Professor Haffkine.

21,981. These statistics which you speak of were made for the information of Government?—I originally obtained these statistics with a view of submitting them to Government, but I found I could not compile anything of any value from them. The young officer had been quite overworked, he was not to blame; he could not possibly keep up with his work at the time, and he seems to have entirely neglected anything like statistical work.

(Witness withdrew.)

Dr. W. D. BETENSON called and examined.

Dr. W. D. Betenson.

21,982. (*The President.*) You are on Plague Duty in Poona, I think?—Yes.

21,983. You wish to make a statement?—I wish to say that I was responsible, to a great extent, for the table (*see* Questions No. 21,416 and 21,788) which was drawn up, grouping the diseases under different headings, to which exception has been taken, and to offer any information that I can with regard to that grouping.

21,984. (*Prof. Wright.*) Was the classification of the cause of death which appears in this table established only on facts observed at the corpse inspection?—No, certainly not.

21,985. It was also made on information received during life?—Yes.

21,986. I find that in your sick visitation you certified 1,900 cases during the year?—There were 1,900 cases of sickness certified by us personally.

21,987. And 600 of those died?—Yes.

21,988. I suppose that those 600 cases with respect to which you obtained information during life by sick visitation are enumerated among the 3,000 cases which came before you in your corpse inspection?—Yes.

21,989. And, therefore, they are included in the table among the 3,000 odd corpses which you examined?—They are included in the table.

21,990. In addition to that there were 2,400 corpses which you had not seen during life?—Yes.

21,991. Then, with regard to the 2,400 corpses, you had no information except that obtained after death?—No, that is not so. The respectable native practitioners sent in to our office, on forms supplied to them for that purpose, a report of all their cases of serious illness, and we received 1,063 of those in the course of the year. As they report serious cases only, the probabilities are that quite three-quarters of the cases which the doctors reported would be found among the 2,400 of which we had no personal knowledge.

21,992. With regard to the 2,400, you have no personal knowledge, but you have had information from native doctors?—To the extent of 1,063. The 1,800 cases are our own, we saw them individually, and each of them had a certificate on the regular form. Then if you add the native doctors' 1,000, you get 2,800 people who were seen in the course of the year by some doctor or other out of 3,035 deaths.

21,993. But some of the 1,063 reported by native doctors you saw while living, and, therefore, they are included in the 1,800 whom you saw during your sick visitation?—Some, but very few. We see on an average, perhaps, three or four a month, and then they would be cases of high fever. We generally write to the native practitioner, if we know him to be a respectable man, and say "kindly send us a longer description of the symptoms of this case," because it is essential not to interfere with the practice of the native practitioners or they would not back us up.

Dr. W. D. Betenson.

24 Feb. 1899.

21,994. Of the 1,063 cases of sickness reported by native practitioners, very few were seen by you?—That is so.

21,995. Then the medical practitioners reported their cases when the patients were practically moribund, is that so?—Most of the native practitioners sent in a report of all serious cases day by day.

21,996. Are the patients, in the majority of cases, already dead when the report reaches you? — Oh, no.

21,997. You say you only saw a few of those cases during life?—We did not take the trouble to see them.

21,998. I thought that every case of sickness which was reported was visited by you?—Not those reported by the native practitioners.

21,999. My difficulty is, that I to-day saw a case visited which had been reported by a native practitioner, and I understood it was your practice to see every such case?—We are more energetic now; if we hear of anybody ill we go and see the case. But, in ordinary times, when there is no plague, unless a man reports a case of high fever we do not go and see it.

22,000. This case which I saw was, as a matter of fact, reported as a case of high fever?—If we have any reason to doubt the report we see the case. I can give you particulars of two cases which were stopped in the city, which are included in our returns of corpse inspection. No details of cases which were sent in were kept until July. After that there were two cases found by corpse inspection.

22,001. You mean the two sporadic cases of plague what were found by you—one in August and one in October?—Yes, they were imported cases.

22,002. The inference you draw from the fact that these two were unreported cases is, that there was plague lingering on at that date in the town?—We have been able to trace every case, I think, up to the 12th February, and we found they were imported from outside.

22,003. You infer from that that the infection died out in the town?—Yes, in May. We had 39 cases imported since. but we can trace them all.

22,004. (*Mr. Hewett.*) Of the 1,063 cases reported by private doctors to you as sick, how many were after-inspected as corpses?—I do not know.

22,005. Will you please get the information?—(The witness subsequently stated that 371 cases were so inspected.)

22,006. Were any of the 106 cases which were found after death to be plague reported to you by doctors in private practice?—No.

22,007. What number of persons whose deaths are recorded in the table do you estimate were not seen in life, either by Government doctors or by private practitioners?—I should think quite two-thirds, 2,000 out of 3,000.

22,008. In case of those 2,000 persons, what means had you of ascertaining whether the record of death which is entered in the table was accurate or not?—We had visual inspection and enquiry.

22,009. What is the nature of your inquiries?—We enquire how long they were ill, and whether they had fever, vomited, or coughed, &c.

22,010. Who made the inquiries?—The medical officer on the spot, through the interpreter.

22,011. Then they were not made direct to the natives of the country by a person who understood the language?—Yes, the interpreter is a native of the country.

22,012. Did the doctor who made the inquiries understand the language?—No.

22,013. (*Prof. Wright.*) Do you think it would be possible, by that method, to distinguish, as you do in your table, between bronchial pneumonia and bronchitis?—The bronchitis in this table includes the bronchitis of old people.

22,014. (*The President.*) But all tables of mortality classified according to the cause of death are full of errors in every country in the world?— Yes, of course this is only rough. The bronchitis includes bronchial catarrh and bronchitis in children.

22,015. (*Prof. Wright.*) Has not the table a fallacious appearance of accuracy? Would it not impose upon anyone who is not a medical man?—Yes, but I maintain they are comparatively accurate.

22,016. Is there not a fallacious suggestion in the table that all these cases are seen during life, whereas, as a matter of fact, two-thirds of them have not been seen till after death?—Yes, certainly. (Note added by witness on correcting proof of his evidence.—No, it is a table of corpse inspection.)

22,017. (*The President.*) You admit the table must contain errors?—Yes, but it is approximately correct.

(Witness withdrew.)

(Adjourned till Monday, February 27, at Satara.)

At The Collector's Office, Satara.

FIFTY-SIXTH DAY.

Monday, 27th February 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S., (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. C. G. DODGSON, I.C.S., called and examined.

Mr. C. G. Dodgson, I.C.S.

27 Feb. 1899.

22,018. (*The President.*) You are Collector of Satara?—Yes.

22,019. You have had experience of plague at Hyderabad in Sind and at Satara?—Yes.

22,020. And have formed some opinions with reference to methods of dealing with plague and the causes of plague?—Yes.

22,021. Can you tell us what your views are about the causes of plague?—I know nothing about the disease bacteriologically. I do not know what plague is beyond that it is a bacillus of some kind or other, but I believe plague may be spread by rats. I do not know that it is, but I suppose it is, because rats frequently die before human beings; but I think that, probably, the spread of plague is mainly due to human agency. I think people take it about in their clothes, and possibly, for all I know, they may eat it. I mean that I have seen people sitting alongside a plague patient in a hut eating food off the ground, with the patient lying within a few inches of the food; it is therefore quite possible that they are eating bacilli at the time.

22,022. Have you any case which seems clearly to show that the disease can be communicated by human agency?—I have known a man go to an infected village, stay there for two or three days, or even less, and come back to his own place and at once infect his family.

22,023. That would include his clothing, probably?—Yes, he had probably brought the infection in his clothing. I have known cases of a person coming in that way from an infected place to his own house, and his own family getting the plague, he himself not getting it.

22,024. Have you any case in which clothing, apart from persons, appears to be the conveying agency?—There was a case two or three hundred yards from this bungalow. A man last year, who was a storekeeper in the camp at Satara, went, after the plague was over, and lived in this village of Kamatpura. A month, or two months afterwards, plague broke out in Kamatpura, and the general opinion was that this man had been stealing the clothes from the dead bodies of women in the camp, and then giving them to his own wife. His wife was the first person who got the plague—he himself did not get it, but the rest of his family got it, and they nearly all died.

22,025. What evidence was there that he had really been taking infected clothes?—The clothes were found in his house, and he could not account for them. Of course, there was no real evidence, on which we could have secured a conviction in a criminal court, that he had stolen them, but that was the general opinion among his relatives and neighbours.

22,026. Do you think it is possible to prevent the spread of plague from one place to another?—No.

22,027. Why?—Because you cannot thoroughly control the people. You might, if you had an unlimited staff and unlimited money, but we have no money and next to no staff here, and we cannot, therefore, control them.

22,028. The people will not voluntarily do what is required?—No. We have very frequently to prosecute a man for leaving an infected place and going to another village without permission, but it is only one case in 50, or one in a hundred, that we actually get hold of.

22,029. In regard to dealing with plague when it has occurred, what, in your opinion, is the most effective of the measures which can be adopted?—If the object merely is to stop the plague, I should say the only thing was evacuation, and segregation of the contacts and the patients.

22,030. Evacuation of the infected area?—Yes, of the infected quarters, or whatever it might be; that is, if the only object is to stop the plague, quite regardless of the feelings of the people and their wishes.

22,031. But as a practical measure, what do you consider the most effective for stopping the plague?—Trying to evacuate, and evacuating as much as possible.

22,032. The more evacuation, the more effective this measure is, in your opinion?—The more evacuation, the more effective I think it is.

22,033. Have you any instance in which, by evacuation, you have been able to stop the extension of plague in an infected village?—I have some figures which I have had worked out which show that, in some cases where plague has broken out in a village and the village has been evacuated, plague has stopped at an early date.

22,034. Would you illustrate that with your figures?—There are many other figures, I admit, which show that if you evacuate the place plague does not stop at an early date; it goes on for a long time.

22,035. Would you give us the figures?—There is a village, Taruk, where the occurrence of the first case of plague is shown as on the 25th November 1897. The village was evacuated, and all the people are reported to have finally left the village on the 2nd of December. There had only been three cases there, and no more occurred after the village had been evacuated. There is also another case of the village of Nandgaon, which was infected on the 15th of November 1897. The people were all out of the village on the 22nd—there had only been four cases previous to, and three more during, evacuation, and no more occurred after evacuation.

22,036. How large are these villages?—Taruk has a population of 1,559, and Nandgaon has a population of 1,402. Then, again, Garawadi, with a population of 1,599, was infected on the 5th October 1898, and the people were all out on the 10th October 1898. There were three cases in the village, and three cases after they went out, and that was the end of it.

22,037. Do you know at what interval of time the majority of cases after evacuation occurred, and whether any of those which occurred two weeks and afterwards could be accounted for by fresh importations?—I produce a statement which shows villages in which the number of cases began to decrease soon after evacuation:—

Mr. C. G. Dodgson, I.C.S.

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1.	2.	3.	4.	5.	6.							
Village.	Population.	Remarks.	No. of Cases before Evacuation.	No. of Cases during Evacuation.	No. of Cases after Evacuation.							
					1st Week.	2nd Week.	3rd Week.	4th Week.	5th Week.	6th Week.	7th Week.	8th Week.
TALUKA KARAD.												
Vathar	1,646	During the rainy weather, evacuation not thorough.	7	12	18	18	19	29	24	18	19	18
Atke	2,088	—	3	80	30	16	10	4	1	3	1	5
Malkhed	792	—	6	2	2	9	11	6	6	1	1	3
Sarli	972	—	6	—	1	14	9	3	—	—	1	—
Saqier	739	—	3	3	6	—	—	—	—	—	—	—
Kalawada	1,717	—	3	—	1	2	—	—	—	—	—	—
Karve	3,500	—	6	11	3	2	8	2	9	2	3	—
Kirpe	606	—	1	—	—	—	—	—	—	—	—	—
TALUKA VALVA.												
Takari	878	—	15	11	1	3	1	2	1	—	—	—
Babe	2,592	—	5	6	10	5	11	7	3	7	3	1
Shirgaon	576	—	2	—	—	—	—	5	—	—	—	—
Retre Harnaksh	2,493	—	5	—	—	5	4	8	4	3	1	—
Gatadwad under Gotkhind.	3,238	—	6	—	7	5	9	—	—	—	—	—
Lonarwadi under Gotkhind.	3,238	—	5	9	10	2	1	—	—	—	—	—
Tujarpur	607	—	6	1	10	7	1	—	—	—	—	—
Ozarde	1,120	—	10	1	16	3	9	3	4	1	4	2
Valva	5,625	—	1	1	—	—	—	—	—	—	—	—
SHIRALAPETA.												
Shirala	4,011	—	2	—	—	—	—	—	—	—	—	—
Bhikarwad under Takve	270	—	6	—	2	—	2	—	—	—	—	—
Dhamwade	483	—	6	—	8	1	1	—	—	—	—	—
Karmale	476	—	4	—	6	2	2	—	2	—	—	—
TALUKA PATAN.												
Garwde	1,181	During the rainy weather, evacuation not thorough.	4	19	19	18	13	5	6	3	1	5
Paneri	440	—	10	—	—	—	—	—	—	—	—	—
TALUKA TASGAON.												
Akalkop	395	—	3	—	—	—	—	—	—	—	—	—
Andumberwad under Akalkop.	3,395	—	2	—	—	—	2	1	1	—	—	3
Khandobachiwad under Bhilawd.	6,985	—	28	—	—	6	4	—	—	—	—	—
Sahiarde	1,543	—	5	—	9	6	9	—	—	—	—	—
Brahmanal	769	—	3	—	11	5	7	2	4	—	—	—
Bhose	2,445	—	3	—	2	—	3	1	2	2	—	—
Bisur	1,410	—	3	—	8	13	2	—	—	—	—	—
TALUKA KHANAPUR.												
Ghoti Bk.	715	—	7	—	—	—	—	—	—	—	—	—
Khambale	658	—	1	17	4	2	4	2	2	—	—	—
Mohi	418	—	3	—	4	3	1	—	—	—	—	—
Hamnant Vadiye	698	—	4	8	6	—	2	1	1	—	—	—
Vazar	346	—	4	1	6	—	—	1	2	1	—	—
Pare	1,656	—	2	—	5	1	1	3	—	—	—	—
Kurli	779	—	2	—	—	—	—	—	—	—	—	—
Ghoti Kd.	794	—	3	—	2	—	—	—	—	—	—	—
TALUKA KHATAV.												
Landewad under Trimali.	736	—	1	—	5	2	6	3	2	1	—	—
Trimali	—	—	1	2	3	13	7	12	7	5	3	—
TALUKA KOREGAON.												
Eksal	761	—	2	14	18	13	2	1	3	—	1	—
Bobdewad under Tadawle	1,282	—	3	5	1	1	2	—	—	—	—	—
Kathapur	1,483	—	5	37	6	5	1	—	—	—	—	—
Jalgaon	1,566	—	3	9	4	1	—	—	—	—	—	—
Shirdhon	1,671	—	2	22	8	5	5	5	1	3	2	—
Losurne	1,892	—	3	—	1	3	16	5	4	1	1	—
Satara Road Station	*	—	1	2	—	—	—	—	—	—	—	—
Ekambe	1,492	—	1	10	6	1	1	4	1	4	3	1

* Not available.

1.	2.	3.	4.	5.	6.							
Village.	Population.	Remarks.	No. of Cases before Evacuation.	No. of Cases during Evacuation.	No. of Cases after Evacuation.							
					1st Week.	2nd Week.	3rd Week.	4th Week.	5th Week.	6th Week.	7th Week.	8th Week.
PETA KHANDALLA.												
Ving	2,157	—	6	3	5	14	8	6	4	1	—	—
Palshi	1,227	—	6	8	10	2	5	3	—	—	—	—
Vadgaon	498	—	12	—	5	—	2	2	—	—	—	—
TALUKA JAVLI.												
Nipani	248	—	1	—	—	—	—	—	—	—	—	—
Saygaon	1,333	—	2	1	3	3	3	3	6	5	—	—
Parbhuchiwad under Kharshi.	703	—	1	3	3	3	3	—	—	1	—	—
Raygaon	883	—	1	—	—	—	—	—	—	—	—	—
TALUKA SATARA.												
Parli	1,889	During very rainy weather throughout.	1	—	14	16	20	20	20	19	16	1
Gajawdi	491	—	6	—	24	20	5	3	2	1	2	—
Kasarsthal	38	—	3	—	8	3	—	2	—	—	—	—
Dhawb	193	—	7	4	—	6	2	—	—	—	—	—
Banghar	221	—	1	—	1	2	—	2	2	2	1	—
Atit	1,871	—	2	39	29	13	5	—	2	1	—	—
Sangaon	634	—	2	16	8	23	21	8	3	2	—	—
Jike	1,431	During rainy weather.	6	28	13	13	11	40	12	6	24	4
Ashte	329	—	2	—	1	2	3	2	—	—	—	—
Borkhal	1,050	—	4	—	41	5	—	6	3	1	—	—
Nimale	513	—	4	—	5	2	14	24	30	7	5	—
Panawdi	110	—	—	3	6	6	—	2	—	—	—	—
Dahiwadi	412	—	—	4	5	8	—	—	—	—	—	—
Are	682	—	11	—	24	5	8	2	1	—	1	1
Rewli	167	—	—	—	12	7	—	—	—	—	—	—
Sonawdi	434	—	8	—	7	7	9	6	9	3	—	—
Chinchner	1,136	—	3	20	2	—	4	2	2	2	1	—
Dhendewad under Tasgaon.	1,835	—	—	2	27	2	—	—	—	—	—	—
umnekhol	199	—	2	—	1	—	—	—	—	—	—	—
Degaon	2,509	—	—	3	—	—	—	—	—	—	—	—
Vadgaon	87	—	1	—	—	—	—	—	—	—	—	—
Kamthi	246	—	1	—	—	—	—	—	—	—	—	—
Ambawdi Bk.	589	—	2	—	2	2	2	—	—	—	—	—
Kus Kd.	171	—	2	—	6	—	3	2	—	—	—	—
Kari	880	—	5	—	12	—	—	—	—	—	—	—
Kashi	561	—	5	—	15	2	—	—	—	—	—	—
Kaloshi	465	—	1	—	2	1	—	—	3	—	—	—
Total	—	—	324	417	555	364	314	255	189	106	94	45

22,038. Can you give us examples of other villages in which evacuation was not successful?—I may point to Mahuli. Mahuli has a population of 1,959. It had 17 cases before evacuation. The people went out two days after the outbreak, and they had 138 cases afterwards, but that was the end of the epidemic. And there is another case here—I do not know what happened in this village, but it is rather peculiar. The village is Ving, with a population of 4,424. Plague broke out on the 4th September 1897, and the village is said to have been completely evacuated on the 13th September; there was one case before they went out, and 295 after they went out.

22,039. So that evacuation was not successful. Have you any explanation of that?—No. I do not know the exact circumstances of the village. I have been to it lately, but the epidemic I speak of occurred in the winter of 1897-98, and I was not in the district then. I came to this district in February 1898.

22,040. Who could tell us about this case?—The Collector then was Mr. Winchester, but he has retired now. There is also a Staff Corps officer, Lieutenant Steen, who was here then.

22,041. Have you other instances in regard to which you have more detailed information?—Here is the case of Vathar, with a population of 1,646. Plague broke out on the 1st June 1898, and the village was reported to be evacuated on the 5th. There were six cases before the people went out, and 204 cases after they went out. I know about Vathar. I went there myself last July. It was raining very hard at the time, and although the people were nominally out in the fields, they were not living permanently in them; they could not do so owing to the rain, and they kept going back to their houses. The day I walked through the village we found a lot of houses occupied that were supposed to be empty.

22,042. This was not really an instance of evacuation?—No. The large number of cases after nominal evacuation undoubtedly was due to the people continually returning to their houses.

22,043. Have you any other case?—Aundh is a Native State village. Plague broke out on the 11th October, and evacuation is said to have been complete on the 15th October. There were five cases before completion of the evacuation, and 165 cases afterwards.

22,044. What was the total population?—3,248.

22,045. How do you explain this failure?—That being a Native State village, it was very badly looked after, and it was never really evacuated, although it was officially reported as having been—all the upper classes, the Brahmans, for instance, were never turned out of their houses.

22,046. What has been the general impression produced in your mind in regard to complete evacuation where it has been properly carried out?—That the

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plague undoubtedly does begin to decrease soon after the people have gone out—within, I should say, a fortnight.

22,047. In regard to some of the villages where the evacuation was unsuccessful, have you any knowledge of the nature of the huts in the camp to which the people had removed?—They are generally huts of a most primitive type. In many cases they consist merely of a few sticks of karbi or grass put up as a lean-to for protection against the sun.

22,048. Is there any exceptional condition with regard to the huts in those camps where you had no success?—The absence of success is chiefly due to the rain, not to the nature of the huts. The people build their huts much more solidly during the rains than they do at this time of the year. During the rains they are tighter and closer, and are like little bee-hives, with a little door which you can just walk in at, and there is, practically, no ventilation whatever.

22,049. This is confirmatory of what you have expressed, that unless you secure free ventilation you do not greatly lessen the progress of plague?—Exactly.

22,050. In addition to evacuation, what other measures do you consider important?—I think you have to make a distinction between large towns—I mean a place like Hyderabad, in Sind, for instance, with a population of about 60,000, and one of these little district villages, with populations of from one to three or four thousand. In these small villages, I think, the patients and their relatives ought to be segregated. They can be segregated fairly effectively.

22,051. That is, in addition to evacuation?—Yes. Without segregation there is no knowing where the members of an infected family go to; they wander all about, and get mixed up with their friends and relatives, and spread the infection.

22,052. In the evacuation camp, you mean?—Yes. But in a large town it is very much more difficult to segregate the contacts and the patients. If it can be done, I think it is undoubtedly a good measure, but, of course, there are great difficulties in the way, because the people hate the idea of being segregated. They do not generally resist actively—they do sometimes, and then the only means is to use force.

22,053. Which would be objectionable?—Yes. It may be a good thing for stopping the plague, but it is a bad thing for anything else.

22,054. In regard to evacuation, in dealing with large towns, what opinion have you formed?—The same idea; if you can get the people out, well and good.

22,055. It is desirable, but not always practicable?—Yes, without a great deal of opposition.

22,056. Are there any other plague measures that you consider valuable?—I believe in letting in fresh air and sunlight into the houses, keeping the windows open if there are any, and opening the roofs.

22,057. If there are no windows?—If there are no windows, in the majority of houses one might make holes in the wall, but sometimes that is not possible, owing to the walls being too thick, or the houses being too badly built.

22,058. What is your view about disinfection by chemical substances?—I have tried it in Sind, and here last year; and we did it here on a very large scale. I do not think it is necessary—I do not mean to say that it does not kill the germ—I do not know whether it does, or does not; but the germ, I think, certainly dies without it.

22,059. If ventilation has been freely done, you think, then, that chemical disinfectants are not required?—Yes, I think so. It may take longer for the house to become habitable; but the house does become habitable sooner or later.

22,060. Have you any examples in which, without opening up a house so as to admit light and air, chemical agencies only were trusted to?—Yes, we did it in Sind. Some of the houses could not be opened up owing to their thick walls and entire absence of windows. There we used only chemical disinfectants, and the house was not opened up; but the plague did not occur again.

22,061. At what interval of time after disinfection were the houses reoccupied?—I was not there when the people were readmitted, but I think it was about two months after the people had been turned out. I have seen the Sind report, and, as far as I can remember, this is what I gathered from it.

22,062. You have had no examples of re-occupation following chemical disinfection at a shorter interval than two or three months?—We have had a case in the town here quite recently. There was a very well-built house outside the gaol, belonging to the gaoler—a house built very much like this, with plenty of windows. There was a case of plague there, and the house was disinfected with perchloride of mercury, and the people went out. On their return, after 10 days, there was a case of plague almost immediately, and the patient died.

22,063. You think the interval should be a long one?—Yes; but I would not trust to that alone.

22,064. What is your experience with regard to the influence of rats in propagating or causing the disease?—Rats undoubtedly die of plague, because one finds hundreds of them that have died in infected places; and I think they certainly die before human beings. I suppose that they carry the plague about from one house to another; otherwise, I do not see how it can spread, because it certainly spreads in an evacuated village. I mean, after the village has been evacuated; the infection does spread from one house to another.

22,065. What is the evidence of its spreading?—You can take a village with a few infected houses at one end, or in one quarter, and turn all the people out; but you constantly find that when the people go back to the other end of the village, or to a hitherto uninfected quarter, and sleep there without permission, they get the plague. There are many cases of this kind. I suppose rats have, in such cases, carried the infection, because I cannot think of any other means of locomotion for the plague.

22,066. Do you know if plague is spread by any other animals?—It may, perhaps, be spread by squirrels and monkeys. I have been told that dead monkeys and squirrels have been found, but I have not seen any.

22,067. Have you any opinion to offer as to the means by which infection seems to extend in certain directions from the originally-infected area?—I have seen it go across one side of the street, but it is rather slow in crossing.

22,068. Do you mean that it usually extends by continuity of dwellings?—Yes.

22,069. Supposing there were an interval between two dwellings on one side of the street, would you expect it to stop at that interval?—No; it would get across, but it might be delayed by this interval.

22,070. Why, then, would it not get across a narrow road to the other side of the street?—It would cross it finally, but it would be delayed. If there was traffic up and down the road, this would probably make the rats more chary in crossing the street.

22,071. That would apply more to the day-time than to the night?—Yes.

22,072. Rats are more likely to move about at night?—I suppose they are; but rats burrow from house to house at closer intervals than the breadth of a broad street, with probably traffic going on over their heads.

22,073. Have you any example to show that grain has been so infected with plague as to convey infection to man or the lower animals?—No. I have never heard of a case.

22,074. (*Mr. Hewett.*) What was the maximum number of villages which you had infected in the Satara district at any one time?—It was 114 on the 25th November 1898.

22,075. At what period of the year do you find that plague is most prevalent?—I do not think it matters much. As far as we have seen hitherto in the two epidemics in this district, there is less plague in the hot weather. For instance, it began to die out last year about the month of February, and practically stopped in April, when the weather got hot. This year it seems to be doing the same; but in both years it was very bad from July up till February, *i.e.*, during the rains and the cold weather.

22,076. Is it not practically impossible to evacuate a village on a black cotton soil during the rains?—We did evacuate such villages, but the evacuation was not thorough; and the people constantly went back to their houses.

22,077. You cannot keep the people out of the village site?—No, not in rainy weather; it was practically

impossible, as they cannot continue to live up to their knees in mud and water. If they do that, then the plague is probably just as bad outside as it would be inside the village.

22,078. When the plague broke out afresh after it died down to a certain extent in the hot weather last year, did it reappear in the same villages as had previously been infected, or in new ones?—Mostly in others, I think.

22,079. Do you remember whether those others were in the immediate neighbourhood of the villages which had been infected before?—Yes, they were, but the infected and the non-infected villages were fairly distributed all over the country.

22,080. Is it your general experience that a village adjoining a village infected in the first epidemic got infected in the second epidemic?—Not necessarily, but plague has run down the western part of this district fairly regularly. Excluding the hill portion of the west, it has run down a broad strip, perhaps 30 miles wide from north to south, and it has been mostly confined to that strip in both epidemics.

22,081. Has a village infected in the first epidemic, as a rule, escaped in the second?—Yes, I think that is so; if they have been attacked in the second epidemic, it has generally been in a milder form than in the first epidemic.

22,082. (*Mr. Cumine.*) Do you remember what the population of the district is?—About 1,225,989.

22,083. How many Staff Corps officers or other special European officers have you for plague work at the present time?—Five Staff Corps officers and one English doctor.

22,084. With so few European officers to work against plague, and with such a large population and so many infected villages to deal with, do you think it possible to work plague measures against the active opposition or even the passive opposition of the people?—No, not satisfactorily. You can do a great deal in the way of evacuation and segregation, but it is never perfect. I mean, supposing the European officer has perhaps 12 or 15 villages, actually reporting plague at the same time, and scattered over an area of, perhaps, 200 square miles, he can only go to each of these villages once or twice a week. While he is there he does the best he can, and gets arrangements more or less into working order. Then he goes away and does not return for, perhaps, a week, and he then probably finds his contact camp empty and his village practically re-occupied, and he has to begin all over again.

22,085. To make evacuation yield its maximum amount of good, it has to be accompanied by two or three complementary measures, such as cutting off the people from the infected village site and getting them to isolate their sick, has it not?—Yes, certainly.

22,086. Where a Staff Corps officer has about 15 villages to look after, can he carry out these complementary measures which are necessary to make evacuation have its full effect?—He can only start them, and then trust to his subordinates, the Hospital Assistant, and the Plague Circle Inspectors, and the Mamlatdar. He must trust to them to try and keep the measures in working order.

22,087. But, personally, he cannot see to them?—No; he can only start the arrangements and must trust to his subordinates to carry them out, and keep them going regularly.

22,088. If every plague stricken village is evacuated, the people are unable to contrast what happens in a village which is evacuated and where the people are prevented from communicating with the infected site and made to isolate their sick, with a village in which the people do not go out at all and nothing whatever is done. That contrast is not before their eyes, is it?—No.

22,089. Do you think it would be better, and have a greater educational value, if each Staff Corps officer confined his attention to two or three villages alone close to one another, and made evacuation completely effective in them, and managed to stop the plague in them within a week or ten days, and thus enabled the villagers all round to see what the maximum amount of good is that evacuation can do? Do you think that would be a better plan than the present one?—In some ways it would; but as against that you would have the fact that the people frequently evacuate themselves. As soon as they really get scared, and realise that there is a dangerous epidemic among them, they go out of their own accord without any driving on the part of the European officer. Of course, having gone out, they would not segregate in the sense that we would; they would not bring all their sick into one field and call it their segregation camp; each family would move its patients away, very likely, from the family hut, and put them in a hut 10 or 12 yards away.

22,090. Would they boycott anybody who went into the village and brought back infection, thus nullifying all the good results achieved?—They would give information to the authorities if he was a low caste man, but not if he was a Brahman.

22,091. The extent to which evacuation produces good results depends largely on the season, I think I understood you to say—that is to say, in the rains evacuation produces hardly any good results whatever?—Hardly any.

22,092. Does it depend to some extent also on the employment of the inhabitants? That is to say, if a village is a purely agricultural one, I suppose the people do not feel going out so much as if they were Banniahs and Marwaris?—No, the ryots go out quite readily, but the traders object.

22,093. Do you remember inwhat villages the plague appeared first of all, what month it was, and in what part of the district? The reason I ask is that we have had a theory laid before us that the germ, if imported straight from Bombay into a dry open *desh* village, appears to be unable to infect the village; that it requires a damp place like Lanauli as a half-way house to get partially acclimatised in before it can infect a dry *desh* village?—We have had cases brought from Bombay here, but the present epidemic came from the Sangli State, a Native State in the South. The first infected village in this district was a village called Sangwi. That was infected in October, 1896, and the infection came from Bombay. I was not there, but I think it is so. The present epidemic certainly came from Sangli, although villages have got the infection from Bombay. The infection lingered on in one or two villages in the south of the district during the hot weather of 1898. Then it got worse in Sangli, which is just over the border, and it gradually spread northwards into our district. But there have been cases of plague coming up from Bombay, and villages have been reported to have been infected owing to this. It is very difficult, however, to get the exact truth as to how a village does get infected. The following is a short account of the manner in which this district has suffered from plague. The first village to be infected was, as I have already stated, Sangwi, which has a population of about 700. A man came up from Bombay with plague and the result was that in a few days the disease spread in the village and 38 people were attacked. The first case in this village occurred in October, 1896, and the last case in February, 1897, but the disease did not spread from here to any other village. On the 16th February 1897 the village of Akhade, in the Javli Taluka, was found to be infected, and on the 27th February 1897 a neighbouring village called Waluth was found to have been attacked. Both these villages were infected from Bombay and not from Sangwi, which is more than 20 miles from either of them. About the same time cases began to occur in Phaltan, a small Native State in the north of this district. This was practically the whole of the epidemic of 1896-97, the total number of cases being only 88. The last case in 1896-97 occurred in the week ending 10th April 1897 at the village of Bahule (Taluka Patan). The district then remained free till the 9th July 1897 when plague broke out at Karad, a town with a population of 13,209. As a matter of fact, there is reason to believe that there was plague at Karad before this date, but it was not officially reported. From Karad a case went to Kaledhon, a village some 35 or 40 miles further east, and from these two centres the epidemic spread rapidly in all directions, especially around Karad. The weather was raining at the time, and owing partly to want of staff, partly to the weather, little could be done for a long time. From July to December 1897, the epidemic was very severe. It was chiefly confined to the two talukas first attacked—Karad and Khanapur. The town of Karad alone had 1,457 cases, and the Karad

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Taluka had 6,448. The total number of cases in the district during 1897-98 was 15,186. The town of Satara with a population of about 25,000, was infected from Karad, although a case was also imported from Bombay. The epidemic began in the month of October 1897, and lasted until April 1898, the total number of cases being 720, with a death-roll of 612. Evacuation was freely resorted to everywhere, both in towns like Satara and Karad, and small villages and everywhere it seemed to be the only effective measure. In other words, there was nothing for it, but for people to run away from the infected spot. The last case in Satara Town occurred on the 4th April 1898. No further indigenous cases occurred in Satara City until 7th October 1898. Since then the disease has lingered on making but little progress, the cases varying from about 3 to 10 every week, and every fresh centre being met by the evacuation of the surrounding houses. The district has practically been never quite free since its severe attack in 1897-98. No cases were reported for a few days in April and May, but plague lingered on in two or three villages in the south throughout the hot season of 1898. It gradually became worse in June and July and spread northwards until at the end of November over 100 villages and hamlets were infected. We have throughout tried to meet it by means of evacuation of the infected quarters and segregation of the sick and their relatives, and in 1897-98 we made a free use of perchloride of mercury as a disinfectant, many villages being disinfected from end to end. This year, we have used very little in the way of chemical disinfectants as they are too expensive, and their benefits open to question. We have also always insisted on ventilating all infected houses, making holes in the walls and opening the roofs. A little inoculation with Prof. Haffkine's serum was done, chiefly in Satara Town, but the people did not take to it readily, and the experience we had with it has been too small to justify any conclusions being drawn.

22,094. You spoke, I think, of the advantages of segregation in a town, but you also said that even after a village has been thoroughly evacuated, the plague seems to have the power of spreading by itself from house to house. If that be so, does that not discount to a great extent the advantage of segregation? —It does to a certain extent, certainly, but the fewer people there are in the town, the fewer there are liable to get attacked, and the fewer the plague centres from which the plague may spread.

22,095. Has it been noticed at all whether the second epidemic in this district was milder or more severe than the first one?—I think the percentage of deaths on attacks is very much the same as it was last year, but the number of cases is somewhat less; for instance, in the epidemic of 1897-98 there were 15,906 cases in the district, whereas during the present epidemic there have been up till now only a little over 10,000 cases. The cases have been fewer, but the death-rate is about the same.

22,096. (*The President.*) More virulent?—About the same virulence, I should think, as last year. About 75 or 80 per cent. of the infected cases die, I should think.

22,097. (*Mr. Cumine.*) You have a Civil Surgeon in the district. Have you any other European doctor permanently stationed in the district?—No. We have one on plague duty temporarily, and there is a Civil doctor at Mahableshwar. He is Superintendent of Mahableshwar, but he does not help us in the district.

22,098. As regards the inspection of corpses, do you think that the Natives would have much objection to inspection of corpses by European doctors?—I do not think they would have.

22,099. Do you think the Musalmans would have any objection to corpse inspection by a Hindu doctor, and the Hindus to corpse inspection by a Musalman doctor?—They would not in this district, because the ordinary Muhammadan here is of a very low type, he is half a Hindu; but in Sind, I think, they certainly would object.

22,100. Have you any reason to suppose they would object in this district?—I do not think the Muhammadans here attach very much importance to their religion, they are much the same as Hindus.

22,101. Do you think they would object to having the corpses of their women, for instance, examined by anybody, whoever he might be?—A doctor can answer that question better than I can, but I think several Muhammadan womens' corpses have been examined by European doctors. Here, in Satara, they generally are examined by the lady doctor.

22,102. If it were to be done by European doctors alone, the town of Satara is the only place where it could possibly be done, is not that so?—That is the only place where we have a doctor to do it.

22,103. The Civil Surgeon of Satara has a great deal of other work to do, has he not, in looking after the Civil Hospital and the Jail and the town?—Yes.

(Witness withdrew.)

Lieut.-Col. H. Hay, I.S.C.

Lieut.-Col. H. Hay, I.S.C., called and examined.

22,104. (*The President.*) You are in the Staff Corps?—Yes.

22,105. And Chief Plague Authority in Satara?—Yes.

22,106. How long have you been here?—Since the 7th of October 1898.

22,107. (*Mr. Hewett.*) You had some prior experience of plague elsewhere, had you not, before coming here?—Yes, I had four months in the Thana district at Bhiwandi.

22,108. What is the population of Bhiwandi?—15,000 is the normal population, but during the epidemic it went down to 7,800. I took the population by census.

22,109. When did you go there?—I went there on the 23th of May 1898.

22,110. At that time what was the strength of the population?—About 12,000.

22,111. About how long had plague been present when you got there?—They had a few straggling cases, within the month of May, for about a fortnight.

22,112. When did the epidemic begin to be bad?—About the 15th June 1898.

22,113. And how long did it continue?—It continued till the end of September.

22,114. During that time what measure did you take?—We were instructed by the authorities to deal gently with the people, without the application of force, and to try and get them to co-operate with us in checking the spread of the disease.

22,115. Were the people mainly Hindus?—No, a large number of them were Muhammadans—Momins.

22,116. Did you evacuate the town, or did you restrict yourself to removing patients from infected houses?—We treated most of the patients in their houses at their earnest request.

22,117. Did you find that that was a good measure or not?—I found that it was a very bad measure.

22,118. Why do you think so?—I have some carefully collected figures here of Dr. Ernest Hill's, the Chief Medical Officer at Bhiwandi. The collection was made at the end of the epidemic. From these figures it appears that, supposing one case occurred in a house, it was 100 to 3 against an inmate getting plague if he went at once into segregation, or if he attended his friends in hospital outside; but that if he remained there, out of every hundred, at least 16 were taken.

22,119. How many people went to hospital?—153 persons actually went to hospital, and 1,625 were treated in their own houses.

22,120. Can you say how many people got the plague by reason of being attendants on sick persons?—I cannot say that.

22,121. Did you disinfect the houses in which these people lived?—All those houses were disinfected.

22,122. While the people were actually suffering?—No, not until they either died, or were discharged.

22,123. Was there no attempt at disinfection in a house while a case was being treated?—Never.

22,124. Did you notice in Bhiwandi any mortality among rats?—A great deal.

22,125. Did that occur immediately after your arrival there?—I think I observed it about a fortnight or so

after my arrival, but others had remarked it before I arrived. In one of the worst infected quarters of Bhiwandi I remarked a bad smell emanating from a shop which had been closed for two months. I forced the door open, and on entering, discovered several dead rats. One rat was actually dying. It was crawling across the floor, and I killed it with a stick. I ordered the rat holes to be opened up, and I discovered no less than 57 dead rats in various stages of decomposition. Some of them were skeletons. They had burrowed into the walls and into the floors. Plague was raging on all sides of this shop which apparently was the centre of infection from which diseases radiated. It seemed to be the exact centre, as plague was very bad all round there. I thought that a notable case.

22,126. Were you able, by your inquiries there, to make out that the mortality among the rats began before any imported case of plague occurred?—No, I could not say that.

22,127. Did you notice that any particular classes of persons were immune?—I did. I noticed that the rice cultivators were a very strong example of that. They numbered 600 or 700, and they lived in very small huts in the midst of this epidemic. Their occupation took them out from morning till night in the heavy rains—transplanting rice. They had not a single case amongst them. They were continually in the open air, while the other people were shut up in their houses with the windows and doors closed. These people were working outside the whole time.

22,128. Did you notice that any particular class was especially subject to attack?—No; I only noticed those who lived in huts, and in inferior dwellings with bad ventilation. The worst portion of the town from a sanitary point of view was the worst infected spot. I noticed that the fakirs were immune. A very large number of fakirs come to Bhiwandi. They pass through it on their way to somewhere. I never heard of a single case amongst them.

22,129. Muhammadan fakirs?—Both Muhammadan and Hindu. They live an out-door life; and I think that is the reason why they do not get attacked.

22,130. Did you come from Bhiwandi to Satara?—Yes, straight.

22,131. What is the population here that you have had to deal with?—I have had to deal with about 19,000.

22,132. In the town?—Yes, in the town.

22,133. How many cases of plague have occurred since you came?—Only 146.

22,134. Have cases occurred among any particular class of people, or in any particular section of the town?—Cases have occurred chiefly amongst the poorer classes of people who live in the poor houses.

22,135. Have cases occurred in houses in which there were plague cases last year?—That is the remarkable thing about it. Many of the divisions which were badly infected last year are not infected at all this year.

22,136. Were the houses in which plague cases occurred ast year disinfected?—They were all disinfect

22,137. Has any instance come to your knowledge of a case of plague recurring in a house which was disinfected last year?—Yes; I can give you a case. This is the case Mr. Dodgson referred to—the Head-Jailer's house. That, I think, was a very strong example. That house became infected on three separate occasions, after having been thoroughly disinfected three times with a solution of perchloride of mercury, 1 in 1,000. It is a large stone house, built by the Public Works Department, with a galvanised iron roof, and very well ventilated. The Jailer's daughter was seized with plague on the 9th January 1898. The house was immediately evacuated, and disinfected with perchloride of mercury. When general disinfection of the whole town took place in the following month by the order of the Collector, this house was again disinfected with perchloride of mercury, but, notwithstanding this double disinfection, a second case of plague occurred on the 20th of December 1898, when another daughter of the Jailer was seized with plague and died. Again the house was evacuated, and disinfected most thoroughly with perchloride of mercury under my personal superintendence. The Jailer and his family returned to the house on the 31st December 1898, and 10 days after both the Jailer and his wife were seized with plague and succumbed, after an illness of 24 hours in the case of the husband, and 48 hours in the case of the wife. As a result of a most searching inquiry, these cases are not traceable to any other cause than the house. The family kept practically aloof from outside infection, and they were very particular about it.

22,138. Do you think it possible that any clothes remained in the house which were not disinfected?—I do not think so. Everything was cleared out, and all the belongings of the deceased were burnt.

22,139. Were all the belongings of the daughter burned in the first instance?—I believe so. It is the practice. I, however, was not here then.

22,140. Were all the clothes of these people disinfected when they went out?—They were, before they left hospital to return to their house.

22,141. I mean when they left their house; were all the clothes of the people who went out disinfected?—The clothes which they took with them to the hospital were disinfected before they went back.

22,142. Did they leave any clothes inside the house?—I am not aware of it. I saw the house was completely gutted out.

22,143. On the other hand, I understand that you have noticed that the houses which were infected last year have escaped this year?—I have noticed that in a very marked degree.

22,144. Although they are in the neighbourhood of places which were infected?—Yes, in the neighbourhood.

22,145. In addition to your work in the city, you have had to do with villages in this taluka?—Yes, and the suburbs, which include cantonments.

22,146. How many villages have been infected in the taluka?—57 villages have been infected this year.

22,147. Have you noticed that the villages in a particular situation have been specially liable to infection?—I have noticed all the towns and villages on the banks of the river Krishna in particular. I have brought a map* with me to show the Commissioners what I mean. All the villages on both banks which were infected this year are marked in red. You can contrast it with the other portion of the taluka away from the rivers, where there has been very little plague.

22,148. It would appear from the map that many of the villages on both sides of the river have been infected, but comparatively few away from the river?—Practically, it seems to have confined itself to the Yenna and the Krishna.

22,149. The chief difficulty which you find is in getting early notification of the existence of the disease, is it not?—That is the difficulty which we have; but as time goes on, and the people become educated, and understand the advantages of giving early information, we have not had that difficulty so much.

22,150. Is that difficulty due to the people not wishing te report, or to the fact that they do not know when plague is among them?—The reason is because they do not wish to turn out of the village—the inconvenience.

22,151. Do you think that is the only reason?—That is the chief reason.

22,152. Do you think that they generally know at once that plague exists among them?—I think nearly all the villagers know it now.

22,153. Have you had pneumonic plague here?—I have only seen two cases of it. I do not think there has been much pneumonic plague.

22,154. Have you tried inoculation?—Yes, we have; but to a very small extent compared with the size of the place. We have only 691 people inoculated in the city out of a population of between 18,000 and 19,000.

22,155. Have people shown no desire to be inoculated?—No. I have tried every means in my power to persuade them, even to the extent of promising readmission to their houses; they have been promised that those who have been evacuated should be allowed to return if they would be inoculated; but it has had no effect upon them at all.

22,156. Have you any results as to the effect of inoculation?—I have a few. The Pet (or ward) called Rawiwar which is inhabited by Mahars and other low caste people, has 68 houses and a population of 292. In December 1898 it was found necessary to evacuate the Pet, as cases had occurred in 13 houses. Out of this population of 292, 107 had been inoculated. As an

* Not published with the Proceedings of the Commission.

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experimental measure, at the suggestion of Dr. Thomson, I allowed those who had been inoculated to remain. No case has occurred amongst them up to date, although the area in which they have been living must have been full of plague germs, infected houses being on all sides of them, some actually touching.

22,157. Have the houses been disinfected?—Yes, with perchloride of mercury; and the roofs have been taken off—or, rather, a portion of the roofs—about 3 feet broad.

22,158. Did the people who went away without being inoculated have any plague among them?—Yes, they had; but I could not give you the numbers.

22,159. Did you place those people whom you took out of their houses in camp?—Yes, they were placed in camp at Godoli.

22,160. Do you know whether they had plague in the camp?—Yes, they had; but I do not know how many cases.

22,161. Was anybody supervising them while in camp?—Yes, we had a Hospital Attendant, and the doctor visited it daily. The medical officer would know the exact number of those people who were afterwards attacked with plague. Dr. Smith will be able to give you the information.

22,162. Do you think that disinfection is a useful measure?—Yes, as a repellent, but not as a destructive agent. The second epidemic in Satara, in my opinion, might have been as bad as the first (it is very much less this year, about one-third, or something like that) had it not been for this general disinfection ordered by the Collector of all houses, which was carried out early in 1898, before I came to Satara. I think that has had the effect of stopping the spread of plague in every house that was disinfected. I think disinfection makes the area less palatable for the microbe. That is to say, if you took two houses (one which had been saturated with perchloride of mercury, and the other had not), I think it would prefer the one which had not been disinfected.

22,163. How can this be if the bacillus does not travel about at a rapid rate?—I think it has been kept aloof, to a certain extent, by perchloride.

22,164. Would you not expect that, if a disinfectant had this repellent effect, it would also have a destructive effect?—It does not seem to have been strong enough in a case like the Jailer's house.

22,165. Can that be in any way due to your solution of perchloride of mercury not having been of the strength you thought it was?—No; I am very particular about mixing it. I have it done under the superintendence of a medical officer once a week. The strength is 1 in 1,000.

22,166. One of the measures which you think of extreme importance in dealing with plague is the system of what you have described as perfect surveillance; what do you mean by that?—The town is divided into 24 Pets, and each Pet has an honorary secretary: and under him he has so many voluntary helpers. Every morning they go round to the houses. They have a little census on the wall outside, with the number of the occupants of each house, and their names. They have a sort of roll-call every morning; and if they find an additional member of the family they inquire into the newcomer's antecedents, where he or she came from. The medical officer goes round periodically and examines those people; and in that way it has been found that plague cannot get to any great dimensions without our knowledge. I am kept informed every morning of the result of these house-to-house visitations. For 10 days after people arrive from Bombay they are under this surveillance—visited daily.

22,167. In order to carry that out you have to rely upon the active co-operation of the people themselves?—Yes, upon the active and intelligent co-operation of the people themselves.

22,168. I suppose they are moved to that by the fact that they had these two outbreaks in the town?—Yes; they work very willingly.

22,169. Supposing you were dealing with a large town which had not been unfortunate enough to have suffered already from plague, do you think that the people would realise the extreme importance of keeping an eye upon new arrivals?—No; I think this is the result of the education which the first epidemic has given them.

22,170. That would be a great difficulty in dealing with a newly-infected town, would it not?—Yes, it would.

22,171. (*Mr. Cumine.*) Were there two epidemics in Bhiwandi?—Yes, two.

22,172. Were you present at both?—No, only the second.

22,173. During what months did the first epidemic prevail?—The first epidemic was imported from Bombay, and began in December, 1896.

22,174. How long did it go on?—It lasted up to the middle of April, 1897.

22,175. How many deaths were there in all?—491 cases and 434 deaths.

22,176. Do you know to what extent the people left the town?—Nearly the whole of them left. Dr. Dalal, who was in Bhiwandi, in comparing the two epidemics, said that the mortality being so small in 1896, and so great in 1898, one would naturally ask the reason for the difference. In 1896 there were 491 cases, and 434 deaths, and in 1898, 1,788 cases, and 1,255 deaths. He explains this by the fact that plague broke out at a different season of the year in the second epidemic; and that the people of their own accord left the town and went into huts during the first epidemic. During the second epidemic we were prevented by the rains, which confined the people to the town, and which, consequently, made a great difference in the mortality.

22,177. Is it within your knowledge to what extent the plague in the second epidemic visited the same houses as it did in the first one?—It is within my knowledge that it visited the same houses and the same quarters.

22,178. I do not quite understand your ground for saying that the treatment of the sick in their houses had a bad effect at Bhiwandi?—I will tell you. The reason was this. These houses were so close together and thickly populated that it was utterly impossible to isolate the sick. I had to institute prosecutions in several cases of surreptitious visitations—generally by night—of the friends of the patients, who would go and sit alongide the bed, and in that way help to spread the disease into the town. Constant intercourse between the sick and the healthy outside is the evil effect of house treatment. I found I could not stop it by prosecution.

22,179. Did you distinctly trace cases of new infection to a visit to a sick person?—Yes, very often.

22,180. Did you put the patients on beds?—When we could.

22,181. But not always?—No, not always.

22,182. If you left the patient lying on the floor, and if you did not disinfect the floor daily, then the treatment of the sick in the house did not have a fair chance, did it?—I do not think it had a fair chance. In many cases they were lying on cow-dung floors.

22,183. You did not disinfect the floors daily?—Not until the patient was disposed of, either by death or discharge.

22,184. You spoke of rice planters being exempt. Are the rice planters out working in their fields during the night?—No, they are not; but they spend a very short time in their houses. They get up very early in the morning, before daybreak, but they sleep in the houses.

22,185. Did you carry out any corpse inspection at Bhiwandi?—Yes, we carried it out.

22,186. Did you strip the bodies?—They were not all actually stripped; they were examined to see whether they had plague or not.

22,187. By whom?—By the Hospital Assistant. The bodies were not allowed to be disposed of until a certificate was sent by the Hospital Assistant.

22,188. Did a European always accompany the Hospital Assistant?—Not always.

22,189. Supposing no Europeans had been there, do you think the people would have permitted the inspection of their dead by a native Hospital Assistant?—I do not think that the Memons would. They would not allow their women corpses to be inspected. I have a chart* here, which I made yesterday, on the Bhiwandi epidemic, showing where the people were treated in their houses.

* Not printed with the Commission's Proceedings.

22,190. (*The President.*) Which year is that?—Last year, during the rainy season. This chart shows the result of home treatment.

22,191. Have you any other chart which contrasts with that, showing other treatment?—Not a chart of sufficient contrast. I have two charts* of the Satara city and the taluka up to date.

22,192. (*Mr. Cumine.*) Had you any cases of plague amongst the Musalmans of the better classes in Bhiwandi?—No, hardly any at all.

22,193. Had there been many cases amongst the superior Musalmans, do you think there would have been a difficulty in effecting corpse inspection amongst them?—If there had been amongst the women, there would have been great difficulty, because they were zanana women—pardahnashin.

22,194. Do you think corpse inspection could have been carried out amongst them at all unless there had been Europeans present?—I do not think so.

22,195. Supposing you had the town of Bhiwandi to deal with over again, what measures would you, with your present experience, attempt to carry out?—I could not do otherwise than I did then if it was in the rainy season. In the dry season I should make every one of them go out.

22,196. And in the rainy season?—In the rainy season I should have to use force to make them go out. A large amount of accommodation would be required. Houses would have to be built upon piles, because it is a rice-growing country, and very wet.

22,197. It is not practicable?—It is not practicable; it is impossible.

22,198. What would you do?—I should, of necessity, have recourse to the same system.

22,199. Will the inhabitants of villages which have been infected once or twice do their best to keep infection out?—Yes; they will evacuate the place of their own accord. Now, even on the discovery of dead rats, some of the inhabitants of the villages under me do not wait for plague to break out, but evacuate the place at once—immediately on the discovery being made.

22,200. When they have evacuated do they abstain from re-visiting an infected house?—We cannot always keep them from revisiting the house—that is the difficulty.

22,201. Will they go back into the infected village site?—Yes.

22,202. They have not realised the danger of doing that?—No.

22,203. Will they isolate their own sick?—They will do that to a certain extent, but not enough. They will not keep sufficiently away from the sick.

22,204. Do they think that danger lies in the clothing of infected persons?—No; I think they believe in the poisoned atmosphere of the houses.

22,205. Do they believe in having their houses perchlorided?—They are very sceptical about its benefit. They believe in sunlight and air. They have very little objection to stripping the roofs off; they believe it does good.

22,206. Would they strip off the roofs of houses of their own accord?—I think they would now—all those who have had experience of plague.

22,207. Have you tried the kiln method of disinfection?—In one case only. Yesterday I had the floor of the Jailer's house dug up, preparatory to burning it.

22,208. You have no experience of it?—No; I am trying it now.

22,209. Have you noticed in this district a clear case of recrudescence of plague as opposed to re-infection from without, say from six to nine months afterwards?—Only in the way of a second epidemic the next year.

22,210. Are the villages which are being attacked this year the same that were attacked in the former epidemic, or are they for the most part a different set of villages?—They are a different set. That is the curious thing about this epidemic. This year it passed over most of the villages which were attacked last year, and *vice versâ*.

22,211. Have you noticed that even when it does get into a village which was badly infected in a former season it does not seem to spread much in that village?—No; I have not remarked that. During the first epidemic in the taluka there were 15 villages infected, with 193 cases and 149 deaths. During the second epidemic, which began in August 1898, there were 57 villages infected, and they are at present all evacuated. Up to that date we have had 2,560 cases, against 190 the year before; and many of those 15 villages which were infected last year have not been infected this year at all.

22,212. How many of those 15 villages have been infected this year?—I am sorry to say that I have not got the figures.

22,213. Are those villages so geographically situated that you would have expected them to be attacked this year?—Yes. I can give the instance of a village called Anewadi, which was very badly infected last year, and three other villages within a mile of it, Parbuchiwadi, Saygaon, and Kharshi. Those three villages are within a mile of Anewadi, and they are all very badly infected this year. There was not a single case in Anewadi until two days ago, when there was one solitary case, which, I think, was imported. Those three villages are very badly infected, and other villages which were uninfected last year have been badly infected this year.

22,214. Have you any idea whether the freedom of this village is due to the sharp look-out kept by the inhabitants?—To a great extent. I have found them turning people back of their own accord. They have barriers across the entrance to the village. It is one of the few instances in which they have really taken the initiative themselves, and taken an interest in it.

22,215. Do you think that the plague measures which are to be successful in the future must be worked with the co-operation of the villagers, and indeed by the villagers themselves?—I think we have to a very great extent to be dependent upon their co-operation, and the education they receive from the experience of plague induces them to take the initiative.

22,216. Which do you think is of the most educational value for the people, one European Staff Corps Officer endeavouring to look after 15 villages or his taking two small manageable ones thoroughly in hand personally?—I think it depends a great deal upon the man, whether his movements are active, and whether the villages are at a distance. For instance, the group of villages which I mentioned are almost within a mile of one another. It would not be enough work for him to look after those four villages. He could take a great many more than that, and visit them morning and evening.

22,217. (*The President.*) What are the huts of the rice cultivators like?—They are mud huts, with very heavy thatch. They are very badly ventilated, and there are no windows.

22,218. They stay in them only a very short time, is not that so?—Yes.

22,219. That is, relatively to other people?—Yes. They are very early risers. They rise before daylight.

22,220. In the case of villages which escaped infection this year, and were infected last year, was thorough disinfection carried out in the huts?—Those which were infected this year simply had strips of the roof taken off.

22,221. What was done with those which were infected last year?—Only the roofs stripped off. I was not here then. I believe that is all that was done.

22,222. Was there no chemical disinfection?—I do not think so—not in the villages.

22,223. Has it been noticed whether rats have appeared in the villages which have become infected this year?—In a great many cases rats have appeared. The village of Umbowda Budruk is a good example of a village where the disease has attacked rats before it has attacked human beings. Rats were found in a house in the village on the 23rd of November 1898, and seven days after this discovery plague broke out in the house in which these rats were found. Six members of the family died of the disease. The village of Arch also, in the Parli valley, is another instance. On the 1st and 2nd of October dead rats were found in two houses, and on the 3rd of October plague broke out in both houses, and in those adjoining them. Nine people were seized on that date. I think these are good examples. I can give a great many others.

22,224. Have any dead rats been found in the houses which were infected last year, but which have escaped infection this year?—I could not tell you.

* Not printed with the Commission's Proceedings.

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22,225. Not to your knowledge?—Not to my knowledge.

22,226. (*Mr. Hewett.*) In those villages you mention in which dead rats were found, are you convinced that there had been no imported cases?—I am quite convinced. I made a searching inquiry.

22,227. How far off was the nearest infected village in each case?—The village of Parli was nearest—I should say within four miles.

22,228. Do you think rats would travel that distance?—It is quite possible. I have seen them go long distances.

22,229. That is how you would account for the infection?—It is quite possible they brought it from another village to Parli.

22,230. Was there any communication whatever from this village of Parli except by means of rats?—Yes, people go backwards and forwards continually—the same class of people.

22,231. (*The President.*) What is the nature of the water supply of the district we are considering?—All those villages on the banks of the Krishna get their water supply from that river, as a rule.

22,232. Those villages which have been chiefly affected are in the neighbourhood of the river, and are supplied by the river?—To a certain extent from the river.

22,233. How are those villages which are not near the river supplied with water?—By wells.

22,234. Taking the supply of the villages chiefly affected, it is from the river, is it not?—Yes, from the river.

22,235. And the water supply of the villages which have largely escaped is independent of the river?—Yes.

22,236. Is there any system of sewage disposal here?—No; it is all hand lifted into the carts, as far as I know.

22,237. What is done with it after that?—Then it is carted out, I do not know exactly where—trenched.

22,238. Is there any chance of the admission of sewage into this river?—There is no discharge of sewage into this river.

22,239. The only possibility is that an infected village might discharge part of its sewage into it?—Yes, perhaps so. There is a good deal of intercourse between the villages on this river.

22,240. Is there a also good deal of intercourse between the people living in the villages on the river banks and the people who are in villages removed from the river?—There is.

22,241. I believe there are a good many temples and bathing ghats on the river, are there not?—Yes.

(Witness withdrew.)

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Capt. G. S. THOMPSON, I.M.S., called and examined.

22,242. (*The President.*) You are in the Indian Medical Service?—Yes.

22,243. Will you state your medical qualifications?—I am M.B., M., Ch., M.A.O., of the Royal University of Ireland.

22,244. In what places have your duties been in connection with plague, and of what kind have they been?—For about seven months I was in sole medical charge of the Parel Plague Hospital in Bombay, and since 31st July 1897 I have been on plague and other duty here.

22,245. You have, therefore, come in contact with a large number of plague cases, I presume?—Yes.

22,246. Have you inquired into the question of the infection of Bombay?—That came before us very often.

22,247. What was the result of your inquiry?—For many reasons, I came to the conclusion that most probably the infection was conveyed to Bombay from Hong Kong. My reasons for thinking so are as follows. As not every ship that left Bombay during the epidemic of plague since it broke out there carried away plague patients or plague infected rats, so it is probable that not every ship which left Hong Kong carried away infected rats. Possibly some particular ship may have cleared from Hong Kong to Bombay. I think the distance all through would cover the incubation period of plague, so it is not likely that a patient can have brought it from Hong Kong to Bombay.

22,248. You think it would be too distant?—Yes, without plague symptoms being developed on the voyage. Of course, there is the possibility of concealment and mistaken diagnosis. But the infection may have been brought by plague infected clothing, or by rats. In this connexion I refer to a number of ships which left Bombay, I think about ten only, on which plague had broken out, and only one barque which left Calcutta during the time Calcutta was infected. I think, therefore, plague rats brought plague into Bombay and landed at Mandvi, where grain is stored, and which is near to the docks, and thereby infected Bombay rats, which conveyed the infection to the houses of the people who afterwards became infected.

22,249. Mandvi was the district first infected?—It is considered to be the first place which was infected. At any rate, that is where plague cases were first noticed. The objections to that are, that intermediate ports, such as Singapore and Rangoon, were not infected before Bombay. My explanation of that is that they are not grain exporting ports, and of course, it is possible that the particular plague-infected ship which infected Bombay may not have called there, supposing it was only one, whereas Bombay for five months of the year does export grain. Therefore, there was an inducement when the plague-infected ship came to Bombay for the rats to land there, to forsake their dead, and try to seek new quarters.

22,250. You have considered the other possible sources of importation, I believe?—First, I may mention that it can hardly have been imported from one of the Himalayan villages by pilgrims. That possibility has been mentioned to you. The towns and villages which the pilgrims visited *en route* must be equally, if not more, insanitary, and as fitted to propagate the epidemic as Bombay, and the inhabitants must be equally susceptible to it, and yet they did not become infected. On the contrary, we find that plague spread from Bombay northwards towards those towns and villages. Then again, I know, as a matter of fact, that those pilgrims are particularly immune to plague by sleeping in well ventilated temples or in the open air.

22,251. What would be the shortest period of time in which a person might come from that district to Bombay?—These people would naturally travel on foot and take months.

22,252. We will take the shortest possible time. Suppose that some generous person were to pay their railway fares?—Perhaps they could do it in seven days, but I am open to correction upon that statement.

22,253. You think that it might be done within the incubation period of ten days?—It might be, but, as I have stated, it is not at all likely that these people would come by that means.

22,254. Have you considered how plague was imported into Satara?—It was introduced from the districts. The districts were affected probably in the month of July, especially about Karad. Before July 1897 there was a missionary on a visit there, and he reported to the then Collector that there were many deaths of suspicious fever, but steps were not taken until later on, in fact, not until two months after that was reported. I was not here at the time. The place at which plague was introduced, according to the official account, is, as the Collector, I think, mentioned, Mani Rajuri. It spread to the talukas, and then it was brought in definitely to Satara.

22,255. How many cases occurred in the first epidemic?—We had 719 attacks up to the end of February 1898. I can complete the figures up to the end of the first epidemic.

22,256. Will you complete the mortality also?—I have the table of both.

22,257. Can you give the numbers now?—Up to date there have been 1,160.

22,258. Can you give us the totals of the first and second epidemics separately?—I can do that, but I

have not the figures now. I consider the first epidemic ended on the 1st April, and then we had dropping cases in May and June. Afterwards, we began to have others in the rainy months, and then the second epidemic began. I can produce a statement. (The figures afterwards supplied by witness are as follows:—)

SATARA MUNICIPAL LIMITS.

First Epidemic, 873 cases; 727 deaths,
Second Epidemic, 287 cases; 209 deaths,
up to 31st March 1899.)

22,259. Can you tell us the total number of attacks during the first epidemic, and the case mortality?—The case mortality was about 66 per cent, I think.

22,260. When did the second epidemic commence?—We had one case on the 8th August, another on the 10th, and another on the 16th, and so on. The second epidemic really began about the 27th September 1898. It is rather curious that that is the same date on which the first epidemic began.

22,261. Were the cases which occurred in the interval imported cases, or cases which seemed to have originated here?—They were indigenous cases.

22,262. Were your means for preventing importation so perfect that you could be certain that there was no further importation?—We had a definite history of plague rats travelling in the direction in which the first cases occurred, and we had no history of importation. The patients first attacked certainly did not come from outside, and we had no history of persons visiting or sleeping in their houses. The roads were well guarded on all occasions. We had quarantine to keep out plague.

22,263. Have you observed any facts with regard to immunity from plague amongst human beings?—Amongst Europeans and Natives, I think, I have noticed it. In the last epidemic, although we had 45 adult Europeans, 20 European children, and 125 European soldiers, not one was attacked, although 20 Europeans and one lady nurse were daily engaged in plague operations. They remained completely immune. I should like to mention that Europeans now and at former times are not equally susceptible.

22,264. Will you state your views about that?—I can bring proof that in Surat in 1639 Europeans were not attacked; that is stated in Snow's Report,* and in Bombay we know they were reduced to almost one half. Regarding the comparative immunity of Europeans now and in the past, I am unable to prove that Europeans lived under the same sanitary conditions as regards ventilation (although from the Barracks Commission Enquiry, and the old Barracks, *e.g.*, in Bombay, now used as Commissariat godowns, we may infer that ventilation was not provided for in the past as now), but we do know from certain annexe to bungalows that the relations of Europeans with certain classes of natives was one of greater intimacy than happily prevail now-a-days. This may have led (as in Parel Hospital it undoubtedly did to three sepoy ward-orderlies being attacked) to Europeans falling victims in previous plague epidemics. My explanation is from the historical evidence in a well-known book, Moor's "Hindoo Pantheon."

"'In Bombay and Western India,' by James Douglas, vol. ii. p. 253. (Sampson, Low, Marston, & Co.), there is a footnote as follows:—

"Bombay: Change of Fashion (1810):—'This 'pleasant and salutary article (cow dung) is falling 'into disuse with the English, who, in their habitations 'and habits, are departing more and more from the 'sober dictates of nature, and the obedient usages of 'the natives.

"'We now, for instance, build lofty rooms, admitting 'insufferable glare and heat through long glazed windows fronting the sun, reflected by marble or polished 'floors; domestic comfort is sacrificed to exterior 'decoration.

"'No man of taste would now build a low sun-excluding verandah, nor mitigate the intensity of the heat 'by a cow-dung flooring. In Bombay the delectable light 'that, 20 or 30 years ago, was so commonly admitted 'through thin, semi-transparent panes, composed of 'oyster shells, is no longer known among the English 'except in the church; and these, perhaps, will, when 'the present worthy clergyman shall vacate his cure, 'give way to the superior transparency of glass. The 'church will then be like our new houses, insufferably 'hot, and the adaptation of punkahs . . . will be 'necessary.'"

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In marked contrast to this, the houses of the first factors or settlers at Surat, as attested by the ruins of some, and the continued standing of others, were large, roomy, and well ventilated. Europeans at the beginning of this century everywhere in India may reasonably be supposed to have maintained the same standard of personal cleanliness.

Then we had no Eurasians, Native Christians, missionaries, or their families attacked, and there were 527 such in Satara city and cantonment. Thirdly, no Parsees were attacked. They comprised 50 souls. Of the hospital servants, ward boys, sweepers, corpse bearers, ayahs, &c., of whom there were from 60 to 65 in the first epidemic, only one was attacked, and that is mentioned because it can be clearly shown how he became attacked. Again, none of the jail population were attacked.

22,265. How many prisoners were there?—There were 198 prisoners. Then, again, the depôt-sepoys, the 3rd Bombay Light Infantry, with their wives and families, remained immune; total 385. In the first epidemic the Sadr Bazar remained free.

22,266. That is a locality. You were speaking with regard to people?—Two other classes of people who, I think, remained practically free were the Buruds (cane workers), of whom there were 1,060, and the Dhangars (shepherds). The Buruds are said to be a dirty and degraded class, living in miserable huts and very poor, according to the Gazetteer. The Dhangars generally go out and attend their flocks during the epidemic months, and the Buruds lived in the outskirts of the village, and it is for that reason, I think, they were exempt, because they lived in the open air during the epidemic months. When we had the plague here they left the city. The sweeper caste are not so much affected as one would expect. On the theory that it is a filth disease, one would expect a great many more sweepers to be attacked. In Satara, during the first epidemic, we had 214 Brahmans attacked out of a Brahman population of 5,249. I quote from a table giving the plague attack by castes in Satara city from the first epidemic.

22,267. Did you ascertain the number of the members of each of these castes?—The Buruds in Satara number 203, and there are 186 wandering beggars actually living in Satara. They visited the town every day, and they come here twice a week for alms into the town—Tuesdays and Thursdays, I believe—and not one of them has been attacked; and I have frequently inquired into the matter.

22,268. Is there any other occupation which seems to affect the incidence?—No.

22,269. Will you kindly put your table in?—Yes, it is as follows:—

PLAGUE ATTACKS and DEATHS, by CASTES, in the SATARA CITY, 1897-98.

Castes, with English Equivalents.	Population.	Attacks.	Male Deaths.	Female Deaths.
Brahmans	5,249	214	102	81
Mahrattas	6,048	232	96	86
Musalmans	2,789	64	31	25
Mangs, night-soil labourers	656	6	3	2
Dhers, tanners	408	4	1	0
Malis, gardeners	589	17	8	6
Rajputs	25	19	2	6
Janjams, worshippers	65	2	0	
Banniahs, money-lenders	437	18	8	7
Goldsmiths	621	5	2	3
Shoemakers	440	3	1	2
Gujars, money-lenders	333	24	11	6
Washer men	126	4	3	1
Tailors	1,772	31	10	15
Kasars, brassfounders	527	11	5	6
Butchers	18	2	1	1

* *See* p. 66 of "Report on the Outbreak of Bubonic Plague in Bombay, 1896-7," by P. C. H. Snow, I.C.S.

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PLAGUE ATTACKS and DEATHS, by CASTES, &c.—*cont.*

Castes, with English Equivalent.	Population.	Attacks.	Male Deaths.	Female Deaths.
Marwaris, money-lenders	331	5	2	3
Barbers	444	14	4	8
Mahars, night-soil labourers	525	6	4	0
Shepherds	104	4	0	2
Sangars, blanket sellers	221	11	4	5
Telis, oil pressers	527	11	7	3
Karanjkirs, saddlers	45	7	4	3
Timmen	57	9	0	0
Parbhu, Gujarati Brahman	113	4	2	2
Tambolis, betel-leaf seller	62	3	1	2
Carpenters	212	6	2	4
Banjaris, grain traders	197	6	0	1
Mehtars, sweepers	140	9	6	1
Alari, metal moulders	43	1	0	1
Christians	57	1	0	0
Pedlars	11	1	1	0
Blacksmiths	84	1	0	1
Gosain, beggars	128	—	3	1
Masans	60	—	1	1
Jewellers	13	—	1	0
Lonari, coal merchants and burners.	210	—	0	1
Coppersmiths	57	—	6	3
Fishermen	367	—	2	2
Lakheri, bangle seller	40	—	1	1
Hymn singers	71	—	1	0
Palwegars, silk-workers	—	—	5	3
Shenni, fish-eating Brahman	—	—	1	0
Weavers	149	—	1	2
Potters	172	—	1	2
Totals	—	—	344	300

The under-noted castes furnished no plague cases:—

Castes.	Population.
Parsee	63
Jews	15
Buruds, basket-makers	203
European Christians	155
Goanese	70
Gaolis, milkmen	126
Europeans	102
Madrasis	13
Arabs	17
Eurasians	36
Naikinis, prostitutes	33
Bairagis, wandering beggars	186
Total	1,018

22,270. You spoke about immunity with regard to locality?—I refer to Bombay. The Halalkhors and the people who live on ships have been particularly immune. That I can account for, according to my theory.

22,271. What about the Halalkhor class?—They are a sturdy class, and live in municipally constructed huts or houses, which are better ventilated. Dr. Weir has referred to that.

22,272. With regard to ships?—Of course, they are well ventilated too.

22,273. Have you anything to say about localities?—Last year the Sadr Bazar here, only a mile distant from the plague-stricken city, remained immune, with a population of 2,335. There was constant communication between the city and the Sadr Bazar. The reason for that was the fighting ahead of plague in those places; the houses were unroofed in strips, to let in sun and air, and, therefore, they were well ventilated. That was not done this year, and the Sadr Bazar has had an epidemic. There was no fighting ahead of plague this year, although I advised it as regards the Sadr Bazar, and they had a severe epidemic about six weeks afterwards.

22,274. Can you give us any explanation which would cover all these cases of immunity?—It depends on the habits of the people. Referring to the castes, it depends on the condition of ventilation of the houses and the habits of the people as regards their knowledge of the necessity for fresh air and cleanliness in and about their houses. Of course, the districts which were exempt last year were compulsorily ventilated by unroofing the houses by strips at a time, and holes being knocked into the walls before plague came.

22,275. What have you to say with regard to cleanliness?—I do not say that filth has nothing to do with the causation of plague, because we know that filth spoils the air and makes it unfresh equally with deficiency of fresh air, overcrowding, or bad ventilation.

22,276. You think that the explanation common to the several instances of special liability to plague is to be found in impurity of the air?—Yes.

22,277. And conversely, that the relative purity of the air explains the instances of impunity from plague which you have mentioned?—Yes.

22,278. Have you any views to advance with regard to the diffusion of plague?—I think it is chiefly spread by human agency, including under that term infected clothing and bedding. I think, also, it is spread by animals to which the germ is pathogenic — rats, squirrels, and, to a lesser extent, monkeys.

22,279. Have you any clear cases in which the clothing appeared to be the medium of conveyance?—As regards Satara I have not a specific instance to give.

22,280. Have you any instance elsewhere?—I think not, except, historically, from the literature of plague.

22,281. Can you give us an instance in which rats conveyed plague?—I think rats conveyed the plague to Satara city from the first infected places here this year. Before the plague began in the city, I used to get 20 rats in a week to examine from the houses in the city next to the Post Office and next to the infected suburbs. I examined these by bacteriological examination and *post-mortem*, and found invariably that they had died of, or were subject to, plague.

22,282. What did you find in the *post-mortem* examination?—Slightly inflamed glands in the inner side of the thigh, and enlarged spleen. Those are the signs we used to go on in Bombay. That was confirmed by cultures.

22,283. What did your bacteriological examination include?—Growth on agar.

22,284. And the ordinary morphological characteristics, I suppose?—Yes; I had no means of going into it thoroughly with a microscope. We had not an oil-immersion lens.

22,285. Therefore, you trusted chiefly to cultures?—Yes; the characteristic culture on agar.

22,286. I think you have some evidence to give with regard to the possibility of animals in a lower biological scale being infected?—I made *post-mortems* with the cultures on squirrels and also on leeches which had been applied to plague buboes before they had suppurated, and I have made what I thought characteristic growths that I got from those leeches afterwards. I made a *post-mortem* on two monkeys, only one of which suffered from plague; the other had not died of plague.

22,287. You did not do anything more with regard to leeches beyond making cultures?—I had no means of doing anything else. I wrote to Dr. James and he could not account for a village, a great distance outside the cordon, being infected by plague, and I suggested that perhaps the leeches used in the plague infected camps were taken outside the cordon and used for other diseases. He inquired into the matter and said that he had strong reason to believe that that was the cause of the villages at a great distance becoming infected.

22,288. What measures have you found most effective in dealing with plague in Satara?—Evacuation is the first and most important to be carried out quickly and effectually. But one must have an idea of what it means. The word is in everybody's mouth. The reason, I think, it is successful is, that first it removes the people from their infected houses and thereby diminishes overcrowding, and if they are put into Government constructed huts, or huts which are

properly constructed, they get into fresh air, which neutralises the plague. Only under those circumstances will the measures be successful.

22,289. You wish to point out that the mere fact of evacuation is not sufficient, but there must be certain things attended to in that evacuation; what do you think is the most important?—That the Government huts should be ready for the whole population of the area to be evacuated. It is useless removing them from structurally insanitary houses to huts equally air-tight, because that would defeat the benefit of evacuation almost entirely.

22,290. Is that the result of your experience?—It is from my experience of Satara, and some villages which I know continued to have plague after evacuation.

22,291. Can you narrate your experience?—The town of Limb was completely evacuated, and yet plague continued for months afterwards, because the people were allowed to hut themselves in an area of 5 miles round the village, and they did not go into Government constructed huts. They continued to have plague for months after evacuation. Plague lasted eight weeks before evacuation with 45 deaths, and 22 weeks after with 521 deaths.

22,292. How do you account for that?—Because they went into badly ventilated huts.

22,293. What were the characteristics of these huts which produced the bad ventilation?—First of all their structure. They were made of bamboo poles, and they used matting for the walls, while the roof was constructed of grass. We leave air spaces on the top, but if the people are allowed to build their own huts they will build them of karbi, and daub them inside and outside, and make them as air-tight as possible, with very small openings, and they will also overcrowd them.

22,294. That was the condition of the huts in the instance which you have given?—Yes, of those huts in which plague continued to occur. I only visited those places occasionally, and had not many opportunities of verifying these facts. There were other huts constructed as the Collector described, with only a few stalks of this karbi and those remained free from plague so far as I can remember.

22,295. Have you any definite instance in which the evacuated people continued to have plague among them where that continuation was, in your opinion, due to want of ventilation in the huts they occupied?—The town of Rahmatpur, of 6,670 inhabitants, had plague for 15 weeks after complete evacuation owing to the insanitary huts to which they went. Before evacuation plague had lasted seven weeks, and there were 106 deaths before, and 162 deaths after evacuation.

22,296. Will you describe those huts?—They have the same characteristics as those of Limb which I have described. I have seen them.

22,297. Have you any experience of partial evacuation?—We had only partial evacuation of a large town like Satara, and yet plague continued to spread to non-evacuated districts.

22,298. Was that partial evacuation accompanied by disinfection?—Case disinfection only, that is to say, we disinfected the houses in which plague cases had occurred, as soon as possible after a case of plague was reported.

22,299. Were the cases of plague removed?—Yes. Isolation and segregation were carried on at the same time.

22,300. Within what time were the plague houses disinfected after the removal of the patients?—In the beginning the houses were disinfected the same day or the next day, but as the number of cases increased the work, fell greatly behind; we could not get coolies here.

22,301. Partial evacuation with disinfection failed to stop the progress of plague?—Yes.

22,302. What do you mean by disinfection?—Chemical disinfection was used on this occasion.

22,303. Were there no instances in which disinfection was carried out by sunlight?—I tried to get the Collector to allow me to have that done, but he insisted, according to the order of the Plague Commissioner, that chemical disinfection must be carried out in every house in which a plague case had occurred.

22,304. To the exclusion of every other form of disinfection?—Both measures were adopted.

22,305. You opened up the roof as well as applied chemical disinfectants?—Yes.

22,306. What was the chemical disinfectant you used?—A prepared solution of perchloride of mercury, one in 1,000.

22,307. Who is responsible for the preparation?—At first we had men who came from another district who had had experience in this matter. They were natives. Then about the month of February we had a European who came from Karad, and he superintended the mixing of it under my supervision.

22,308. Will you tell me exactly what was done?—First, a solution of perchloride of mercury dissolved in water, with ammonium chloride, was made up and stored in stone jars and corked, and from those a certain measure was taken and added to a kerosine-oil-tin full of water, and that made up a strength of one in 1,000.

22,309. It was stored in those jars until the perchloride of mercury had been entirely dissolved?—Yes. It was made at night in order to be used the next day—a strong solution.

22,310. Are you certain that the perchloride of mercury had been dissolved?—Yes.

22,311. How do you know?—Because I emptied out the contents of the jar the next morning in the first few instances, to see if it had really been dissolved.

22,312. It was an opaque jar, was it not?—Yes, but we emptied it into a vessel so that we could see it.

22,313. And anything solid would be removed from the jar, you think?—Yes.

22,314. Will you describe the process?—We have a certain measure of water, we put it into the jar, and then added chloride of ammonium to it, and then perchloride of mercury in the proper proportion.

22,315. In what form was the perchloride of mercury?—Solid.

22,316. Was it in crystals or powder?—Powder.

22,317. Was the jar shaken?—It was mixed up with a wooden stick with a glass tied to the end of it.

22,318. So that you made certain it was all dissolved?—As far as we could possibly do so.

22,319. There could be no doubt about it?—I should think not. A certain glass measure of that was added to one kerosine oil-tin full of water, and that made it one in 1,000.

22,320. How was this solution of one in 1,000 applied?—We had a supply of wooden pumps and tubs, which were supposed always to be the only things used in applying it. But when the pressure came we had to resort to brass pumps.

22,321. You pumped it with considerable force?—Yes.

22,322. Where?—On the wall, roof, ceilings, and especially the floor. I laid great emphasis on that, that the floor was to be done more carefully than anything else.

22,323. Nothing else was added to this solution?—Very often the coolies did defeat my object, because they put the pump on the ground and then took it up covered with mud, and then put it in. I had, at last, to tie the pump to the tub; in fact, I took every precaution, although I did not believe in disinfection, to give it every chance in a practical way, and I recommended the re-disinfection of plague houses.

22,324. When you discovered this possible source of error you had it corrected as far as possible?—Yes.

22,325. Why do you not believe in disinfection?—Because although experiments in laboratories will kill the plague germ, I was doubtful, from the practical experience I had had, that it would kill the germ under the natural conditions in which we found it in native houses mixed with cow dung floors and so on, and further experiments in Haffkine's and Hankin's laboratories have fully confirmed that view.

22,326. At present, you do not believe in chemical disinfection for plague?—I do not say it is of no use, but it is unreliable.

22,327. It is not a certain measure?—It is not to be relied upon at all. There are better disinfectants, such as sunlight and fresh air, which are more cheaply available.

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22,328. Have you anything further to say with regard to chemical disinfection?—Experiment's from Haffkine's and Hankin's laboratories are before you, and I have nothing more to say except from practical experience. I have some cases in which plague occurred in houses in Satara which were disinfected, and I can put a statement of them in. I have also some cases which occurred outside what is considered the ordinary incubation period of plague, that is to say, more than 10 days.

22,329. Does that deal with chemical disinfection?—The houses were disinfected and the people were allowed to go back, and 15 or more days afterwards plague cases occurred in the same house.

22,330. Of course, you eliminated all other sources of infection?—Yes, the cases are given in the following table:—

SOME INSTANCES of PLAGUE in DISINFECTED HOUSES.

Name.	Pet.	Date of Disinfection.	Date of Attack.	Days after Chemical Disinfection.
N. M. Bhosale	Somwar	15.2.98	22.2.98	7
P. Kodha	„	15.2.98	21.2.98	6
K. K. Maruti	Yadagopal	18.2.98	23.2.98	5
A. K. Krishnaji	Pratapganj	20.2.98	25.2.98	5
S. R. Lawzekar	„	12.2.98	26.2.98	14
S. K. Sitaram	„	21.2.98	3.3.98	10
P. K. Gulabsing	„	21.2.98	16.3.98	23
B. W. Subhana	Durga	27.2.98	26.3.98	27
D. N. Jagatap	Mangalwar	15.2.98	8.3.98	20
G. Rupchand	„	23.1.98	27.2.98	35

The Jailer's house was disinfected by one in 1,000 solution of perchloride of mercury, ceiling, walls, and floors, including the verandahs, front and back, on 18th and 19th January 1899, once; and again on 31st January 1899; yet the Jailer and his wife were attacked by fatal plague on 14th February 1899. This house had been disinfected in 1897, in the month of December, by mercuric perchloride solution, so that the effect of that disinfection was not permanent, although it appeared to be effectual, and by some was credited with stopping further attacks there, as three plague attacks took place in this house in the 1898-99 epidemic. The house was disinfected in the presence of the Chief Plague Authority in January 1899, and the floors twice, the second time with fresh perchloride solution.

22,331. What are the clinical varieties of plague which you have encountered?—I divide them (in addition to primary plague pneumonia or malignant plague) into cerebral, or nervous, and that, has two sub-varieties, quick and slow. I mean by "quick" that it kills a person in a few hours or a day, and by "slow" that the patient lingers on for perhaps three or five days, or recovers. Secondly, there is the septicæmic form, which is also quick and slow as regards its progress. In both these the infection, I think, goes into the blood.

22,332. Why do you think so?—It is only theoretical. We have a supposition of how these diseases had affected people, and we try to account for the fact that they kill people quicker than others.

22,333. By what kind of reasoning have you arrived at your opinion?—From these two diseases occurring without any previous symptoms, and affecting people quite suddenly and killing them off very quickly indeed.

22,334. You mean the rapid development of the disease?—Yes.

22,335. Are there any other forms?—Thirdly, there is the ordinary mild bubonic form, which probably infects through the lymphatics. Then there is a fourth variety which we have identified, which is very rare; that is the abdominal or typhoid, which is also quick and slow.

22,336. Why do you think the third variety is caused by conveyance through the lymphatics especially?—That is a generally held opinion, but I myself have objections to its being conveyed through the lymphatics, because I think the most common method of infection of plague is through the air, although I cannot deny that plague may be conveyed through inoculation from the lymphatic channel, and rarely by cuts and abrasions in the extremities of natives. I have had instances of that.

22,337. Your opinion is not very strong on that?—I think that is the rarest form of infection.

22,338. What is the evidence of the existence of the abdominal or typhoid form?—I have had some cases among the Natives here. Altogether, I have seen one European case infected, and three Natives out of about 750 cases of which I have clinical notes.

22,339. What are the distinguishing clinical features of this form?—General typhoid symptoms and slow development of the buboes. A case is fully reported in the first epidemic. In General Gatacre's Report* I have recorded one case in full, and I have notes of others which I have seen here.

22,340. Could you state what you think are the characteristic features?—The details of this case are confirmed by the other cases which I have seen here of plague, simulating enteric fever. The patient was attacked with giddiness, trembling, chilliness, headache, repeated vomiting of bilious matter, and prostration. This continued for a few days. Then there was diarrhœa of a thin, yellowish, watery, fœtid character, six motions in 24 hours, with griping and gurgling; he was delirious, with an elevated temperature, of course. There was repeated vomiting, and nausea was constantly present. The tongue had a yellowish-brown fur with moist tip and edges clean, the skin hot and clammy, bad odour from the breath, peculiar earthly smell from the bedclothes when turned down. There was a headache and drowsiness. The patient wanted to sleep but could not. The eyes were injected.

22,341. There is nothing there, except diarrhœa, which is distinctive, is there?—The general appearance of the typhoid state, that is to say, that the patient waved his arms aimlessly before his face, sinking down in the bed and fumbling and picking at the bedclothes, with enteric motions which were acid to reaction. There were no typhoid spots, although they were looked for.

22,342. To bring it into a group of plague cases there appears to be nothing but diarrhœa?—And the typhoid symptoms.

22,343. Typhoid symptoms in as far as there are some nervous symptoms?—Yes.

22,344. Have you seen any pneumonic cases?—I have seen 19 cases of primary pneumonic plague, and only one recovery. I wish to mention the importance of marking thoroughly the difference between that and the other varieties of plague.

22,345. What are the distinctive symptoms of plague pneumonia as distinguished from ordinary pneumonia?—A very small area of the lung is affected, as is shown by clinical examination, and the sputum is frothy and bloody, and in culture contains myriads of plague bacilli. It is the malignant form of plague.

22,346. How is it a malignant form?—From comparing it with small-pox, where we have discrete and confluent, and so on.

22,347. Have you found the pneumo-coccus of pneumonia in the sputum?—The German Commission worked out this in Parel, but did not find it.

22,348. Have you made any examination?—No, I have no microscopes.

22,349. Have you seen any very mild cases of plague?—In Parel one very mild case I saw in which the patient was all right in three days and attended to his work. He was a sweeper in the Parel Hospital. I have not seen any here.

22,350. Was any bacteriological examination made?—Yes.

22,351. Have you seen any cases of enlarged glands, which in some respects simulate plague, and could not from the symptons be distinguished from plague?—In Bombay some cases during the first epidemic were sent in as plague which I was able to prove by bacteriological examination were not plague, although they had enlarged glands.

22,352. Do you think that proof can be obtained only by bacteriological examination?—Now, I am of that opinion.

* *Vide* pp. 86-7 of "Report on the Bubonic Plague in Bombay 1896-97," by Brigadier-General W. F. Gatacre, C.B., D.S.O., Chairman, Plague Committee.

22,353. You think there is a disease involving the lymphatic glands, sometimes also accompanied with high temperature, which is indistinguishable from plague except by bacteriological examination? — Quite so.

22,354. Have you any evidence as to the incubation period of this disease?—We take the incubation period from the first case we see generally, and count from that, but it is obvious that patients who have subsequently developed plague have been equally exposed in the plague-infected house as the first patient. Counting in that way we generally find that the attacks develop within ten days, but I have some examples in which it went beyond that period.

22,355. With regard to the etiology, do you think there is any relationship with such circumstances as famine, rainfall or subsoil water?—As regards war and famine, these visitations drive the people into the towns and they overcrowd the towns, and then, if plague happens to come along, naturally the overcrowded town will be more subject to attack.

22,356. Have you any facts with regard to rainfall?—No; I do not believe there is much relation between the two except that the life of the germ outside the human body seems to have something to do with the state of the moisture of the ground. It is in a hybernating condition during the rain, and after the rain it becomes virulent, and becomes able to attack people. The idea is that it is always in the soil, and is alive in the soil, and in rats and other animals outside the human body, and thus the epidemic is continued after perhaps a few dropping cases, and then, subsequently, next year, when the weather conditions are favourable, and when the people go into the ill-ventilated houses, the plague is able to attack them, as we found in Satara.

22,357. Why do you think it occurs so much in seaport towns and large towns?—That is natural, because we know that cities have been built for the sake of commerce on the banks of the river and that these are the emporiums for import and export into which plague will naturally be brought first by communication with other infected places.

22,358. How do you think the virus actually enters the body?—Principally through the air, although I cannot deny that there are other methods by which it may enter.

22,359. You mean, it is inhaled into the lungs?—Yes; that is the most common method, I think.

22,360. Why do you say that?—From the absence of evidence of other means of infection, except in very exceptional instances. One other possible means mentioned is inoculation through cuts and wounds in the extremities, but very few cases confirmatory of that have been found, and in some of those I have been able to recover the plague bacillus from a blister raised on the opposite limb, showing that it was a case of generalised septicæmia, and that this was really an instance of black blister, of which I have seen five or six examples here.

22,361. It did not, in your opinion, indicate the entrance point at all?—Not at all. Besides that, I have many reasons against that theory, and my objections are stated together as follows:—

1. The inoculation theory cannot explain the fact, that fever and general symptoms precede the appearance of the local expression of the lesion of infection, if such exist, and this is the sequence in all the cases of plague that I have seen.

2. In those cases where plague bacilli had been isolated from the supposed initial lesion I was able, at the same time, to demonstrate the presence of plague bacilli in the serum of a blister raised upon the opposite limb; proving that the patients had plague bacilli generalized in their blood, and were, in fact, suffering from septicæmic plague, plague with black blister. All those patients died, which is confirmatory of this view.

3. On this theory of cutaneous infection the occurrence of buboes in sequence, with intervals, and in sites in no way anatomically related with the first bubo or site of supposed inoculation cannot be explained satisfactorily.

4. Whole families are attacked simultaneously or within ten days or so of each other, and it is difficult to believe that all of them should exhibit cutaneous lesions sufficient for inoculation at or about the same time.

5. The rarity of such lesions, although carefully looked for, is an important objection to this view. At Parel Hospital only five such instances were discovered amongst 304 patients, and many medical officers studying plague there were daily examining patients to discover evidence of this mode of infection; and the medical subordinates were instructed to critically examine all admissions for slight wounds, &c., below the affected lymph gland. In the Satara hospitals such lesions were even rarer than at Parel.

6. "*a.* It is difficult to believe that any large proportion of the inhabitants habitually have lesions of the skin—even though minute ones suffice—suitable for the absorption of the infection.

"*b.* We know that in septicæmias and other external infections, a decided lesion is required, and that, even though this be present, infection does not always occur. It seems very improbable that, in any large proportion of those having the smallest lesions, it would chance that those should become infected.

"*c.* Were inoculation by very slight cutaneous lesions the usual mode of infection, the plague would be even more destructive than it is.

"*d.* When once established in a place, the disease has spread more rapidly than if it were diffused mainly by external inoculation.

"*e.* The rarity of the occurrence of plague among those of the upper classes of natives who live in houses of a superior class, and who do not ordinarily frequent insanitary places, yet whose habits as regards the infrequent use of shoes, and in certain other ways, resemble those of the poorer classes.

"*f.* Women's duties as attendants on the sick must have exposed them to the dangers of cutaneous inoculation far more than the men; yet they were (and generally are) attacked in nearly equal numbers. For, of those attacked in Karachi between the ages of 20 and 55, one in every 21·5 of the population were men, and one in every 23·5 were women. Presuming external inoculation to be the rule, it, therefore, appears that it is not more frequent among women who tend and handle those sick with plague, than among men who do less of those duties, which is scarcely credible.

"*g.* The still greater infrequency of inoculation among the staff and attendants in a Plague Hospital; were external inoculation the common mode of infection, it would be reasonable to think that, in Indian hospitals at least, the paid attendants, and even more commonly, the relatives of patients, would, owing to their ingrained disregard of precautions, have frequently succumbed. This immunity appears to prove the truth of aërial infection and to seriously weaken any evidence that exists in favour of internal inoculation. For whilst the conditions favouring the one are, in a hospital, very greatly diminished, those conducing to the other continue to exist for all alike with but slightly diminished strength.

"*h.* The occurrence of infection by way of the lungs is acknowledged by the supporters of external inoculation; and the possibility of the former being granted, it seems somewhat unreasonable, looking at the greater facility with which it would occur, to question its universality. It may be conceded that pulmonary inoculation does cause, in certain instances, a special type of the disease, the chief feature of which is primary pneumonia. But it would seem that it has yet to be proved that the ordinary form of the disease is not commonly conveyed through the lungs. That a general affection of the lymphatic glands cannot result from pulmonary infection does not seem probable.

"*i.* The analogies of other contagions do not seem to favour the external inoculation theory. In none of the other specific fevers does this, normally, occur; whereas in those diseases in which it is possible or usual, local manifestations of infection are the rule (tubercle, leprosy, syphilis, septicæmia, anthrax, diphtheria), or they are entirely absent (tetanus, hydrophobia). But, in their general character, the infections above-named differ entirely from those eruptive fevers (typhus, relapsing fever, mumps) which plague most resembles; and there is no reason to believe that, in any of the latter, infection takes place by external inoculation. In mumps one special gland becomes inflamed, yet it can scarcely be argued that this is due to external inoculation. Why, in a similar manner, should not the whole lymphatic system be affected in plague through pulmonary inoculation?

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"*j*. The rapidity with which plague spreads among families, and among occupants of the same dwelling, seems to support causation by aërial infection. Were external inoculation the usual mode of infection, it seems very improbable that the coincidence of the time of exposure of cutaneous lesions to infection would occur in so large a proportion of cases. Whereas these are easily explained by the theory of pulmonary infection, to which all those inhaling plague-poisoned air are exposed from the first moment of its inspiration.

"*k*. Though cutaneous inoculation may occasionally happen, its general occurrence would seem improbable." The arguments 6(*a*) to (*k*) are quoted from a report* by Surgeon-General Bainbridge.

Professor Aoyoma, in Hong Kong, inoculated himself accidentally and died of plague, and Dr. Stricker, in Bombay, during a *post-mortem* examination, cut his finger and got a mild attack of plague from which he recovered. Animals are easily inoculated with plague. Surgeon Wilm, in reference to the Hong Kong epidemic of 1894, relates that "About 300 Europeans "were employed in disinfecting operations and all "wore boots and putties, yet the few who were affected "all had enlarged glands in the groin. It is extremely "unlikely with such precautions that they had cuts, "&c., on their feet and legs, but they must frequently "have had cuts, &c., on their hands and came in "contact with infected articles; yet none developed a "bubo in the armpit. This shows that direct inocula-"tion through cuts or abrasions was not, and is not, the "usual mode of infection. Infection may take place "by the lungs, or alimentary canal, but nërial "infection is, in my opinion, the most common."

22,362. Do you know of any experiment showing the results of introducing plague virus into the respiratory passages?—There are experiments by the two Russian observers, of the first Imperial Russian Commission, on monkeys: they found they could give plague pneumonia to susceptible monkeys very easily by spraying the solution of the virus in the air in the cage in which they lived.

22,363. Judging from these experiments, would you not expect plague pneumonia to be more frequent than it is, as you think the virus is principally introduced through the air?—There is the possibility to be considered that it may pass the lungs and produce an infection of the lymphatic glands, the ordinary septicæmic or bubonic form, or cerebral varieties even, without specially infecting the lungs, which we would recognise clinically.

22,364. This is very hypothetical?—Yes.

22,365. Have you any opinion as to whether the virus may be absorbed from the alimentary canal?—No; that is a supposition also from the so-called abdominal cases. The natives have a habit of eating food off the ground; of course, their nails are not always clean; the sputum of the patients, especially in pneumonic cases, would infect the ground from which they eat their food.

22,366. That is a possibility, but have you any observed facts?—No, I have no cases to prove it.

22,367. How do you think the virus proceeds out of the body?—Only by those excreta which will contain blood at any time. I have evidence to show that it cannot be excreted by the fæces or urine, unless they contain blood. The German Commission and myself examined all excreta, tears, and everything else, to find the germ, and failed to do so, except in cases where the excreta also contained blood and the sputum.

22,368. Did you find it in the urine?—We never found the germ in the urine unless there was blood also.

22,369. Was that hæmaturia or hæmaglobinuria?—Hæmaturia.

22,370. And the fæcal matter?—Never when it did not also contain blood; in fact, it was extremely rare; I never saw a case in Parel.

22,371. You think, therefore, the virus can only be passed out of the body through an actual lesion of some surface?—So I believe, or from the sputum of a plague pneumonic case, which, I think, is the most important means by which plague infection is given off by the patient.

22,372. Have you any experience with regard to the treatment of plague which you wish to state?—Only the antiseptic treatment, which I introduced. Perchloride of mercury was tried in very large doses, and seemed, along with stimulants and ordinary treatment, like nursing, dieting, and keeping the patient lying down, to give better results than any other treatment I have tried.

22,373. Can you state that in a statistical form?—From a report regarding the Parel Hospital, which I have completed up to that date, and from evidence which I have procured since, I shall go into that question fully. In my précis I ask permission to put in the full statistics. These I have excluded at present, because I thought I had enough evidence on other points.

22,374. Your experience is in favour of antiseptic treatment, I understand?—Yes, combined with stimulants and ordinary nursing.

22,375. Aiming at the source of the illness—the actual cause—I suppose, you mean?—Yes.

22,376. And cardiac feebleness you treat at the same time with cardiac stimulants?—Yes, quite so.

22,377. What are the plague measures which you consider, effectual?—Looking at it from a broad view, the only measure which would be effectual is an alteration in the habits of the people from the etiological standpoint and historical standpoint, and from my experience, I believe that plague is a want of fresh air disease, and that it can be very easily destroyed by fresh air. In that way it is in marked contradistinction to typhus fever. No matter what you do with regard to sanitary houses, like Lord Sandhurst's improvement scheme, if the people do not understand the precautions which have to be taken they will defeat your measures. They will not get fresh air at night, and they will continue to do those things which will tend to continue plague.

22,378. Of course, in a big house, even if the means of ventilation were far from perfect, so long as the house was not overcrowded, the air would remain pure for a long time?—Yes.

22,379. Have you any other measures to mention which you consider useful?—Yes, as temporary expedients. I call all those measures which we have adopted, namely, evacuation, which is a strong measure, and isolation, temporary expedients.

22,380. Evacuation you have already discussed as a means of securing fresh air?—Yes, and that is the ground upon which it is useful. Isolation of the sick naturally comes in, and segregation of contacts in health camps, and disinfection by the real disinfectants, viz., fresh air and sunlight. Of course there are other disinfectants—not chemical—viz., steam and boiling water. Then quarantine comes in to keep plague out.

22,381. You have already expressed an opinion that disinfection by chemical agencies is not a very effective measure in itself?—Quite so. I do not condemn it entirely.

22,382. Have you some illustrations in favour of your view—that fresh air is the most important thing?—I have mentioned the facts in my evidence in connection with instances of immunity. Then there are those which I have already stated with regard to castes, people, and localities, and also from the failure of evacuation and facts regarding the floating population everywhere, not only in Bombay, but also in Canton. Clifford Allbutt's book mentions 250,000 people living on the river. Then I have particular instances. For instance, Commander G. S. Hewett (March 5th, 1898) has forwarded to the Press the following remarks with regard to the Tardeo section to the Secretary to the Bombay Plague Committee: "An extraordinary outbreak of "plague took place in chawl No. 202, Bapty road, on "the night of 2nd instant. At 11 p.m. there was no "sick in the house, and at 4 a.m. on the 3rd (the day "following) there were four deaths, and at 10 a.m. "seven other cases were removed to hospitals. On the "morning of the 4th instant nine *more* cases were "removed to hospitals, making a total of 20 cases in "24 hours. This remarkable outbreak appears to have "been caused by the extreme cold of the night of the "3rd instant, which caused people to *close all the rooms* "inhabited. The chawl, which is in a fairly sanitary "condition, is situate in an open compound, *with* "*plenty of light and air*, and no cases of plague had "occurred in it." That was quoted against me as

* "Report on the Plague in Sind, 1896-97," by the Principal Medical Officer, Sind District—not reprinted in the Proceedings o the Commission.

showing that plague could not occur in a well-ventilated chawl, but the reason is plain. The people shut all the doors and windows on account of the high wind, and immediately in one night they got 20 cases, although for two years previously, although they were surrounded with plague, they remained plague-proof.

22,383. Do you know that during the two years in which they were plague-proof they did not on any occasions shut the doors and windows?—With regard to that, I have no information.

22,384. Have you any other examples?—The Jailer's house is a well-ventilated house. The Jailer's house is an ideally perfect house, even for Europeans to live in, but as he only used the centre room, which may be 14 feet by 12 feet, for himself, his wife, his mother-in-law, and six children, who all sleep on the floor, and in the cold weather they have a charcoal brazier in the centre of the floor, and cover their heads with razais, blankets, and so on, and as all the doors and windows are shut, they have made this naturally well-ventilated house perfectly insanitary, and constantly there was plague last year, and there was also plague this year. The jail, which is next door to it, remained free, although there were plague rats in it, and this year a plague case was introduced into the jail, and there were no further cases, because ventilation is enforced there at night on the prisoners.

22,385. Did not the lesson gained on the first occurrence of plague prevent a continuance of this habit of closing all ventilation openings?—No; the Jailer would not be convinced, although his daughter was attacked. I diagnosed the case on the 17th January this year before I got ill, and I said, "Now, surely, you will give "up your bad habits and preserve your health?" And he replied: "God will take care of my health."

22,386. You have had some experience of Yersin's curative serum, I think?—The total number of cases inoculated by me, or by Yersin, was 27. He injected the first three, and I injected the other 24, in Parel Hospital. Of the 23 cases of undoubted plague, 13 died and 5 recovered, the percentage of mortality being 66·5.

22,387. How does that contrast with the mortality of cases not treated?—The general mortality in Parel was 64·5 per cent., but 66 were moribund on admission and 17 died during the first day in hospital and 38 during the second day. If those cases are excluded, the mortality was 41 with cases treated; but then we must further exclude Yersin's cases, and then the rate of mortality under hospital treatment, separate from serum treatment, was 30·8 per cent. of the admissions who lived after 28 hours in hospital and actually got some hospital treatment.

22,388. This serum was not applied to cases obviously moribund, I suppose?—No; in fact, at the end, Yersin advised me to make selections of cases which had been ill under 24 hours. Even then, the mortality amongst those was, if anything, worse.

22,389. Have you had experience of Lustig's serum?—No. I have not used it myself. We tried it on animals in Haukin's laboratory in Bombay, and did not find it had any protective effect. But then it was not actually the serum, but what he first published in the *British Medical Journal*.

22,390. You have had some experience of Haffkine's prophylactic fluid, have you not?—I have injected 708 cases here, and afterwards only three deaths occurred among them from plague.

22,391. Did these people voluntarily come forward?—More or less. Some compulsion was used, that is to say, they had privileges held out to them if they submitted to inoculation. If they were living in infected places, they were told that unless they became inoculated they would be moved out into segregation and health camps. In one Pet which I quote in my précis, Pantachakote, the total number of houses was 75 with a population of 160. There were 12 infected houses, and 83 people were inoculated between 11th October and the 11th November. There were only two plague deaths, and those two occurred on the first day after inoculation. I know that they themselves resorted to inoculation, because they had had a plague death in their house which they concealed until the next day.

22,392. How many deaths had occurred among the non-inoculated at that time?—The non-inoculated were compulsorily removed out of the locality. I believe there were cases and deaths among them. The whole locality had been infected, and perhaps 35 cases of plague had occurred in this district before inoculation was resorted to, so that the plague had got a grip of the place. The people were allowed to go back into their houses, and no other measures were taken, as far as I remember, as regards non-infected houses. The infected houses were opened up, and the others have since been opened up all over the place, because we could not distinguish between those which had been infected and those which had not.

22,393. Did you experience much difficulty in inducing people to be inoculated?—The people of Satara only resorted to it when we brought statistics before them to prove its great value. The personal factor enters into this matter a great deal, that is to say, the influence of the Collector or the doctor who is trying to get them to resort to this measure. Fortunately also, by the co-operation of some intelligent members of the community, we got the people to resort to inoculation this year, but last year we could not.

22,394. Is it proceeding now?—Inoculation has stopped now altogether; but plague is almost at vanishing point. The last Pet which was infected with plague has been completely evacuated, and that has practically stopped the plague for the last week or so.

22,395. The people are not now so much afraid of plague?—I think they have been educated a good deal.

22,396. The total number of cases which you appear to have inoculated is very small relatively to the population; were serious efforts made to induce the people to become inoculated?—At first we had a public meeting which was announced long beforehand. There were addresses by the Collector, the Deputy Collector, and myself, and we inoculated some Europeans and a child of a public officer in the presence of the assemblage, about 2,000 or 3,000 people. That had a great effect. Then, afterwards, the police offered themselves for inoculation.

22,397. Did you take other means to induce people to be inoculated?—Yes, and to give them an opportunity of judging of its value for themselves.

22,398 And they had ample opportunities for being inoculated?—Yes, three operators were ready to inoculate.

22,399. More than was required?—We used to wait for them two hours in the morning and one hour in the evening.

22,400. That is the utmost you effected in this town?—Yes, but this year plague has not been so bad.

22,401. Have you noticed if any effect is produced upon the progress of other diseases by inoculation?—I have had experience. Where once the reactionary fever has occurred gonorrhœa and gleet have been cured. It has also a great modifying effect upon syphilis.

22,402. How many cases of venereal disease have you seen cured?—Twelve cases of gonorrhœa, two of gleet and only four of syphilis. Unfortunately, I became ill when this was discovered, and so I could not investigate it further.

22,403. How long had the gonorrhœa lasted?—One has to trust the word of the patient; they say for two or three months.

22,404. How many injections were required?—Only one full injection.

22,405. How soon after were the symptoms stopped?—Up to the third day.

22,406. Were these cases verified?—Yes, I have inquired into them, and had the people come up before me.

22,407. Have you seen any cases in which inoculation has done harm?—In Satara I had seven cases which I inoculated, in which what one might call abscesses formed, although I did not actually see pus but only a clean watery serum exude. That was due to the fact that the contents of the bottle had become deteriorated.

22,408. Have you any other facts bearing upon the value or otherwise of inoculation?—Compared with evacuation, I would say that, if everybody could be induced to become inoculated, inoculation would seem to have a greater effect than evacuation, as evacuation is carried out now; but ideally, evacuation with the precautions I have mentioned, would be equally successful with wholesale inoculation.

22,409. Do you speak of partial or complete evacuation?—Complete, and the person should have full advantage of fresh air, on which the value of that evacuation depends.

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22,410. You think that there are limitations to the value of inoculation as a plague measure?—Yes. You cannot get the whole of the people to agree to inoculation, and, therefore, you must resort to other temporary measures in addition. It would be a very good thing if you could get the people to resort to inoculation wholesale.

22,411. Do you think it is hopeless to get them to do so?—I think so. We cannot trust to it alone, it is only a temporary measure for dealing with plague, because although vaccination is of use for small-pox, it has not stamped out small-pox. In the same way we cannot trust to inoculation alone to stamp out plague. No one, in the face of an epidemic, has expressed an opinion that it will check the farther progress of plague for the time being. I look on it only as a temporary measure.

22,412. What do you regard as the most fundamental?—Radical sanitary reform, teaching the people to alter their habits, which is the secret of our exemption, except in the case of plague pneumonia, which any of us might get any day.

22,413. Even in the open air, you mean?—Yes.

22,414. Will you give us your views with regard to the incubation period of plague?—I have known cases where it has been above the ordinary accepted period of ten days. This was amongst families in which more than one attack occurred. There were:—

3	instances	11 days	after removal	to segregation camp.
1	,,	13	,,	,, ,,
1	,,	14	,,	,, ,,
3	,,	15	,,	,, ,,
1	,,	19	,,	,, ,,
2	,,	20	,,	,, ,,
1	,,	26	,,	,, ,,

22,415. Let us take the last. What was the cause of infection in that case?—I have noticed about that the possibility of the man having revisited his house to bring away cooking pots.

22,416. Those are cases which occurred in the segregation camp?—Yes, with the only exception of the man on the 26th day.

22,417. I suppose you apply that possible source of error to all the cases?—There is a possibility of that, but we were quite certain of this particular case; there was a definite history that he actually had visited his plague-infected house to remove cooking pots, but the others were very carefully watched, and the seals of their houses were not allowed to be opened. We had all the locks sealed, and the people were not allowed to break the seals except by permission of the Divisional Officer, and in the presence of the authorities.

22,418. Was there a roll-call at any time of the day?—Yes, that is the practice.

22,419. At what times?—In the morning and evening, and sometimes surprise visits are paid into the huts, in order to find if all the segregated people are in the huts assigned to them.

22,420. The evidence, on the whole, would seem to show that these men, other than the case you mentioned, had, at least, not slept in any hut outside the camp?—Quite so.

22,421. Further than that you cannot go, I suppose?—No.

22,422. Have you any tabulated statement respecting the duration of the incubation period?—I have, and I will put it in, as follows:—

ADDITIONAL EXAMPLES of PROLONGED INCUBATION, 1898-99 EPIDEMIC.

GODOLI HEALTH CAMPS.

No.	——	Admitted.	Attacked.	Incubation.
				Days.
1	Dhondi K. Sidhu -	22.11.98	2.12.98	11
2	Shanker Vishnaranath.	22.11.98	5.12.98	14
3	Case No. 73 -	14.10.98	27.10.98	13
4	,, 74 - -	13.10.98	27.10.98	14
5	,, 83 -	14.10.98	2.11.98	18
6	,, 96 - -	13.10.98	7.11.98	24
7	,, 110 -	4.11.98	14.11.98	13
8	,, 113 - -	5.11.98	16.11.98	11
9	,, 114 -	26.10.98	18.11.98	23

RANCHATRI PLAGUE HOSPITAL, 1898-99.

10	Case No. 11 -	18.1.99	1.2.99	16
11	Prisoner in jail camp "under guard."	10.1.99	21.1.99	11

Such examples occurred in about one per cent. of the people segregated as contacts.

22,423. Is there anything further which you wish to bring under our notice?—The only thing I wish to refer to is, the inverse relation between the height of the temperature and the intensity of the plague epidemic "in a place with a variable climate." That is the most important point in the statement. I have observed the minimum temperature at 8 a.m. We have not self-registering thermometers. At 4 a.m. it would be more telling still. In a place with a variable climate like Satara, when the temperature falls the plague increases. I have prepared a chart, which I produce.* When the temperature is generally lowest, or soon after that, you have a rise in the plague attacks. The chart shows a rise of temperature up to 82, which is our maximum in the hot weather, and there are no cases; and again, in the epidemic of this year, a fall in temperature, which corresponds to a rise of plague attacks. Generally, throughout the chart, the same thing occurs. Of course, there is a time when the epidemic will wear itself out, and then, although you have a fall of temperature, you may not have a great rise of deaths, owing also, perhaps, to measures which have been taken. Perhaps the town is half evacuated for instance. The only objection to that is places like Karachi, where they have had an epidemic of plague in the middle of the hot weather. But I can explain that, because there is no very variable climate, it is very equable, and the habits of the people are not altered by the cold or hot weather.

22,424. Therefore, you come back to the old proposition, that temperature has nothing to do with it, but that it is a matter of fresh air?—This fact of the temperature has also been noticed in the *British Medical Journal* by two doctors. Dr. Polverini and Dr. Galeotti, of Bombay, have written a book noticing the same point.

22,425. And giving the same explanation?—I do not know that.

22,426. In your opinion, plague is an easily prevented disease in civilised communities; what is your reason for saying so?—The knowledge of sanitation and our increased knowledge of plague and the conversion of medical men to the real, true, etiological theory of plague will put everyone on their guard as to how plague may be avoided. It is easily avoided, because we know that Europeans, and the other classes I have mentioned, are immune, and the reason is that they enjoy, and habitually provide themselves with, fresh air. When everyone knows how to do that, they never need be afraid of plague at all, except plague pneumonia.

22,427. (*Mr. Hewett.*) Have you noticed that persons of any particular ages have escaped plague here?—I do not think any definite statement could be made upon that point.

22,428. What is the mortality among the very young—children under five years of age?—33 under the age of five out of 1,152, but one would require to know the number of children living under that age in the town.

22,429. But you know there is a large population, and the fact remains that only 33 got plague out of 1,152?—The impression remains upon my mind that children are not so liable to plague. The adult age, in fact, is the age for plague, but, naturally, there are a great many adults among the population, and their work probably exposes them more to infection.

22,430. Have you observed any places which were infected last year, and have escaped the infection this year?—My work has only to do with Satara.

22,431. Have you observed that any portion of the town escaped last year, and got infected this year?—The Pets which were most infected last year have almost entirely escaped this year. I have tried to account for this, firstly, on the ground of general disinfection; secondly, the people being better educated; thirdly, their not visiting their sick relatives so much; and fourthly, that they have obeyed the rules

* Not published in the Commission's Proceedings.

which, I say, are the primary sanitary safeguards which will enable them to resist plague.

22,432. Do you think that the wards of the town which have escaped this year have enjoyed more fresh air than other people?—Yes, from both example and inducement of the leaders of their community, they are following these supreme sanitary safeguards, and running the risk of dying of diseases which they thought were caused by cold air rather than die of plague.

22,433. Are we to understand that the great majority of the people in places infected last year have altered their mode of living?—Not more than in Pets that were being affected, but native doctors have told me that many in the city are following these safeguards with regard to ventilation and cleanliness of their houses.

22,434. But not more in the uninfected than in infected localities?—I could not state that as a fact.

22,435. Do you feel confident that where you have noticed infection by rats, you have been able to exclude the possibility of cases of plague having occurred among human beings before the rats began to die?—Yes. I have an example in which we very nearly cleared out the infected district, and a large area round it in the first epidemic.

22,436. I was not speaking so much of places within a town, but of a village or town which has got infected from another place?—I had that experience this year, because plague was definitely found to be conveyed by rats, I think, from the little hamlets outside the city into the city by the road which the plague afterwards travelled.

22,437. What distance would that be?—About 600 yards from the village, and there were intermediate places which had dead rats.

22,438. You have no proof of rats having carried the plague a further distance than that?—No, that is my limit.

22,439. At what time of the year did these two places, Limb and Rahmatpur, get infected?—I think, perhaps, in July, but I am only speaking from memory.

22,440. Was it during the rainy season?—Just at the end of the rainy season we began to have dropping cases, but my connection with the villages was naturally not close, because I have been wholly on plague duty in the city.

22,441. Do you think that the people were in the habit of visiting the infected sites after they went out into these huts?—That is possible, but so far as police protection and visiting at night to see that the people were not living in the town are concerned, that was excluded.

22,442. Do you know how many police were looking after the 6,670 inhabitants of Rahmatpur?—I do not know about Rahmatpur.

22,443. How many people were there in Limb?—About 4,587.

22,444. How many police were there to look after them?—Perhaps 30 at most.

22,445. What do you exactly mean by partial evacuation?—In a commercial town, or in a large city, you cannot have wholesale evacuation of the place. There are obvious objections to it, such as trade, &c., and therefore blocks are evacuated, as we did in the beginning of the 1897 epidemic. The infected houses and those for 100 yards round, say, were evacuated, and also the houses which were closely packed together.

22,446. Did I understand you to say that partial evacuation at Satara had led to the dispersal of the plague?—No; I said it failed to stamp it out. The rats conveyed plague from the infected to the non-infected area, and therefore, I think, quarantine and isolation cannot stop plague, unless you can quarantine the rats and other animals.

22,447. Was there plague here in February and March 1898?—Yes, I think so.

22,448. To what extent?—About 30 cases during the whole month of March.

22,449. In the last half of February?—About 60 from the 15th to the 28th February.

22,450. There appear to be ten instances in which plague cases occurred in houses that had been disinfected during February and March 1898?—Yes.

22,451. A certain number of them appeared during the period of incubation calculated from the date when the persons affected are known to have been in contact with persons suffering from plague, but there are others which occurred after that period. Do you contend that the cases which occurred after the period of incubation could not have been contracted by communication with persons living outside those houses?—That was not likely at that time, because the population of the town was very much reduced. Instead of 25,700, it was about 4,000, certainly under 5,000. Therefore, the friends of those people were out of the town, and there was not so much intercourse between them or between others who are not friends as at ordinary times.

22,452. During the time in which these ten cases occurred you had 90 cases in the town altogether; is it not possible that those people got infected otherwise than through the infection being in the houses which they re-occupied?—I do not believe that merely visiting a house during the day will give a person plague if he has been living and sleeping in sanitary surroundings for some time. For instance, we, who are visiting Plague Hospitals, do not carry away infection to our houses, nor did the natives who visited the hospital.

22,453. You do not exclude the possibility of these people having been in the habit of visiting other plague patients in their own houses?—That may be possible, and I do not exclude that, but there would be very few instances.

22,454. Still, it is possible?—I admit that it is possible.

22,455. Are you satisfied that on the occasion of the disinfection of the houses in February, 1898, the solution of perchloride of mercury was actually one in 1,000?—I can make this statement that so far as human agency and foresight—by Europeans as well as Natives—could make it perfect, disinfection by perchloride of mercury, even in the last months, was so. The perchloride of mercury was acidulated with hydrochloric acid, as Hankin recommended. It was carried out as early as it could be. I made it a point to give disinfection by an acidulated solution of perchloride of mercury, the best possible chance of proving its efficacy, although I did not believe in it.

22,456. Who prepared the paper you have just handed me on the subject of the period of incubation?—I, myself, did that.

22,457. Are you responsible for the letter-press?—It is in my own handwriting.

22,458. You say in it: "It is to be noted that re-" infection and concealment accounted for attacks " beyond ten days from the initial case in a family " amongst segregated families. No case of undoubted " plague developed beyond the tenth day of observa-" tion except in one instance, and this person had " been allowed to visit his house after segregation, " and had been known to remove some articles for " use"?—That was a case in which I could not find positive proof, but it was possible in the others.

22,459. I understand you to say a great deal more than that?—There I may have, but I have modified that opinion. That was written a long time ago.

22,460. (*The President.*) You do not agree with what you have written here and you wish an opportunity of re-writing it?—Yes; my opinion may have altered.

22,461. (*Mr. Hewett.*) I wish to know why it has altered?—It has altered from experience. I have found instances since then which extend definitely beyond ten days.

22,462. None of the cases which you have mentioned later are referred to in this letter-press?—No, I have added those cases.

22,463. Where did these cases occur?—In Satara during the first epidemic.

22,464. Do these figures which you gave in answer a question of the President, relate to the people who are referred to in the letter-press?—Yes.

22,465. Why have you changed your opinion here?—Because I have had larger experience since I wrote it. I think in those cases it was not possible for the people to visit those houses, in fact, the seals were not broken.

22,466. Why did you think it was possible when you wrote this opinion?—At that time I did not enquire as to whether the seals had been broken or whether the people had permits.

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22,467. How long after these people had been in the segregation camp did you enquire as to whether the seals had been broken?—Before the end of the epidemic, when I was making up my figures for the whole epidemic again.

22,468. How long afterwards was that?—At the beginning of April.

22,469. When did you write this opinion?—On the 12th March. I wrote this before, in Bombay.

22,470. When did you write your opinion which I have quoted to you in a previous question?—Before the 12th March.

22,471. And when did you write down the figures which you gave to the President?—Before the 12th March also.

22,472. How long after writing your opinion did you change your views?—About four weeks.

22,473. Do you think that it is possible you might change your opinion again?—One always thinks the last opinion the best just as one thinks one's last religion is the best.

22,474. Do you think that none of these persons who were infected in the contact camp could have been infected from being in the neighbourhood of the contacts who became ill while they were in the camp?—I do not think they could, because if what I hold is true, and I believe from my experience that it is true, one cannot catch plague, so to speak, by coming into contact with a plague patient in our sanitary camps.

22,475. Then your deduction as to the period of incubation is entirely dependent on your view that you cannot catch plague by coming into contact with people in the camps?—I think that is so.

22,476. I understand that you wish to place before the Commission facts with regard to certain cases which led you to change your view with reference to the period of incubation?—Yes.

22,477. In these cases are you able entirely to exclude the possibility of the infection having been caught outside the camp in which the affected persons were located?—No, but these people only have left the camps, say from 12 to 2, under a system of passes.

22,478. Why could not they have evaded the guard at night?—We were all supposed to control that under the guard.

22,479. Do you consider that it is possible to keep people in under those circumstances?—No, I do not.

22,480. A certain number of people were taken out of that Pet, and out into the segregation camp. Sixty persons who had been inoculated were allowed to remain in the Pet, and none got plague; but among those who went into segregation a certain number developed plague. I want to know the number?—(The following statement, containing particulars as to plague among persons segregated and inoculated, was afterwards furnished by witness:—

INOCULATION STATISTICS in three Divisions of SATARA CITY 1898–99.

Name of Division.	No. of Houses.	No. of Infected Houses.	Population.	No. of Persons Inoculated.	After Segregation among the Non-inoculated.		After Inoculation among Inoculated.		Date of Evacuation and Inoculation. Week ending.	Remarks.
					No. of Plague Cases.	No. of Plague Deaths.	No. of Plague Cases.	No. of Plague Deaths.		
Durga - -	78	2	333	60	3	2	—	—	7th Nov.	No case since 17th January.
Raviwar -	68	13	292	107	13	10	1	1	8th Dec.	No case since 6th December.
Pantachakote	75	12	160	83	10	7	2	2	10th Nov.	No case since 24th November.
Totals -	221	27	785	250	26	9	3	3	—	—

The three attacks and deaths among the inoculated were on the 1st day of inoculation.
There have been no further attacks among the inoculated, all under strict observation, up till 31st March 1899. Some of the non-inoculated went out, after ten days detention under observation, into fields and to other villages or towns where they are not under strict observation and it is not known if any of them were attacked by plague.)

22,481. Have you had any corpse inspection here?—Yes.

22,482. Who inspected the bodies here?—In the first instance the Hospital Assistant. I was alone here during the height of the epidemic, and when he was in any doubt as to whether he could declare a case to be plague or not, I was sent for. I have even gone to the Muhammadan cemetery at half-past eleven at night to examine bodies.

22,483. Did you find any difficulty in carrying out corpse inspection?—There was no objection as far as I was concerned nor with regard to the medical subordinates.

22,484. Are there many Muhammadans here?—There are 2,789 Muhammadans.

22,485. That is a very small proportion of the total population?—Yes.

22,486. Are the Muhammadans an influential community here?—Very few of them are of any standing.

22,487. Have you noticed anything as to the effect of plague among the ordinary diseases of the population?—I am of opinion that a person who has had syphilis suffers much less from plague, or rather, survives a much more severe type of plague than a person who has not.

22,488. Have you observed that an outbreak of plague affected the general mortality from other causes?—I have not noticed that.

22,489. Perhaps you will put on record the facts which came to your notice with regard to the immunity of persons in the Parel Hospital, of which you had charge in Bombay?—In upwards of 240 instances the friends of the patients attended their sick, and in 20 instances scarcely ever left the bedside, and in not a single instance did the disease spread to the friends. Out of more than 140 attendants on the sick, belonging to the hospital staff from time to time, only one sweeper was attacked, and he had been constantly helping in the *post-mortem* room, and had a very mild attack with small axillary bubo.

I have also statistics to show the non-infectiousness of plague amongst servants in Plague Hospitals, when they are properly hutted on the premises, at Satara, in 1897–9, as follows:—

Ranchaori Plague Hospital, 1897–8:—27 servants and one plague attack and death, disease *not* contracted in hospital, *vide* "Bombay Medical and Physical Society's Transaction," March, No., p. 11.

Ranchatri Plague Hospital, 1898–9:—14 servants; no plague.

Wadha Camp Hospital, 1898–9:—22 servants with one attack and death which was in the person of a corpse bearer, and the source of inspection could *not* be traced as he was in the habit of going outside the hospital camp. The Medical Officer in Charge was able to exclude any recent or special source of hospital infection where the man had been on duty for seven months.

Budhwar Hospital, 1897–8:—27 servants; no plague.

Godoli Camp Hospital, 1898–9:—14 servants; no plague.

The above figures include only *bonâ fide* attendants upon the sick and not policeman, 22 in number, who were engaged at and in the Hospital Compound, and were completly immune. No notice is taken of changes in the establishments (add 20 per cent., say), in this return, which is compiled from the designations of the offices. Total servants 104, with two attacks and two deaths. The conclusion is that special exposure to plague miasm (?) in freely ventilated Plague Hospitals is not specially liable to lead to an attack of plague. It is to be borne in mind that it is not the *locale* of a man that saves him from plague, but the habits as regards hygiene that he follows. No doubt those attacked had insanitary habits, and slept covered up in their blankets, and endeavoured to shut out the cold air in the early mornings, especially of the cold season, and rendered themselves equally liable to attack as the patients they attended had done in their hovels. Occupation *per se* is no preventive of plague. To find complete immunity among such a number of attendants, specially exposed to infection, would argue their possession of habits of living to which they had been strangers hitherto; but that so few were attacked is contrary to what we would have expected.

22,490. Have you noticed a case of a person having plague more than once?—Only in one instance, and there, I think, it was rather a relapse.

22,491. You had one case of a second attack of plague?—Yes, and another patient had a relapse.

22,492. Can you give us some details of the second attack of plague?—It was in a woman, aged 40. She had been convalescent 18 days, and was attacked 27 days after the initial symptoms of the primary attack, and died five days afterwards.

22,493. (*The President.*) Was the woman you speak of as having had plague twice still in the hospital when she was attacked the second time?—Yes, but in the convalescent ward, nearly separated.

22,494. She did not quite recover?—She was able to walk about.

22,495. But you say that she relapsed?—I consider the interval too long, but that was a matter of opinion.

22,496. Was it a case of bubonic plague?—Yes.

22,497. (*Mr. Hewett.*) Have you examined the registers of deaths in the town of Satara?—From the 31st July 1897.

22,498. Do you feel certain that every death is reported?—Yes.

22,499. Are you certain that the cause of death is properly reported?—It was not verified in each case. There was no necessity, because there was no indigenous plague.

22,500. How could it be verified if a death had not to be reported until 72 hours after it occurred?—It could not; the body would be disposed of.

22,501. Did your inquiries lead you to believe that deaths were all reported within 72 hours, and never afterwards?—No. That point did not come up.

22,502. Was it the practice for a medical man to examine the register of deaths?—It was submitted to me daily. The Secretary brought it either to my bungalow, or I went to the Municipal Office to look at it.

22,503. From what date?—I arrived here on the 30th July, and I immediately started to watch the daily mortality. That was the point I was keen on.

22,504. Was it the custom for the Civil Surgeon to examine the register before plague occurred?—Only for a short period I, myself, was here.

22,505. You began it on account of plague?—Because of my apprehension of plague—that the plague was within striking distance, so to speak.

22,506. In the ordinary course, does a Civil Surgeon in the Bombay Presidency look at the registration of deaths within Municipal areas?—I should say that is a very exceptional custom.

22,507. Has he any duties as Health Officer in ordinary circumstances?—No, except in a very cursory manner, looking after the streets and latrines, and that sort of thing. I do not think his duties amount to anything more than, perhaps, suggesting means, and that there should be more filth carts—sanitary arrangements.

22,508. (*Mr. Cumine.*) You are going to give us the figures in Satara town and Satara district of the first and second epidemics. Will you give us the periods, in order that we may see whether the town or the district was ever completely cleared of plague for any appreciable period?—(The following statement was supplied by witness subsequently):—

SATARA DISTRICT PLAGUE RETURNS, 1897-99.

Blank Dates.	Cases.	Deaths.
13.4.98 - - -	0	4
19.4.98 - - -	0	1
22.4.98 - - -	0	0
28.4.98 - - -	0	0
29.4.98 - - -	0	0
5.5.98 - - -	0	1
2.6.98 - - -	0	1
8.6.98 - - -	0	2
10.6.98 - - -	0	0
22.6.98 - - -	0	1
6.7.98* - - -	0	4

* *I.e.*, the last fortnight of April and middle fortnight of June were nearly free.

——	Cases.	Deaths.	Mortality.
Satara City:—Free from indigenous plague, 4th April 1898–10th October 1898:—			Per cent.
In the 1st epidemic -	729	610	83·7
„ 2nd „ till date 31.3.99.	143	118	83·1
Satara Municipalities, including Sadr Bazar, &c., indigenous and imported:—			
1st epidemic - -	873	727	83·27
2nd „ - - -	287	209	72·8
Grand totals:—			
Satara District, till 17th March 1899:			
Imported - -	914	764	83·58
Indigenous - -	25,082	19,647	73·33

22,509. In the rains, in a non-evacuable town, what are the best practicable measures to adopt, according to your experience?—In the absence of evacuation, wholesale inoculation is the next best thing.

22,510. What is the best thing to do with the patients?—If you can, you should isolate them with one attendant in a well-ventilated room in their own house. There is no danger of attending them there. I have on my own responsibility tried that in one case here, in which the family were allowed to remain in their own house. The room in which the patient remained was plague-proof, as I call it, and no case followed. Of course, it was a dangerous experiment. The house was well ventilated, and not overcrowded.

22,511. Did you put the patient on a bed?—Yes.

22,512. Did you throw disinfectants on the floor every day?—There were no chemical disinfectants, but the house was disinfected with sunlight and air. I wanted to try the effects of my own theory as far as possible.

22,513. Were the people in the house attacked?—No

22,514. You did this with one patient only?—Yes. There were five other members of the family. Of course, it was done on my own responsibility.

22,515. Have you any information of outbreaks of mumps appearing in children in a village in which the plague epidemic had died out?—I have no instance of that.

22,516. When the perchloride of mercury solution had been prepared, and was about to be applied to the houses, did you ever take a sample and test it to see what its strength was?—No.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Collector's Office, Satara.

FIFTY-SEVENTH DAY.

Tuesday, 28th February, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President.*)

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. V. G. Ghanekar.

28 Feb. 1899.

Mr. V. G. GHANEKAR called and examined.

22,517. (*The President.*) You are a pleader at Satara?—Yes.

22,518. (*Mr. Cumine.*) In what town have you had experience of plague?—In Satara city.

22,519. In Satara city Municipal limits only?—Yes.

22,520. What were the preventive measures taken when plague had been discovered in Bombay?—Observation camps and detention camps were first established on the roads leading from the railway station and Poona to Satara city.

22,521. Medical inspection was introduced?—Yes, and names of strangers who used to visit the city were every day registered on different posts, with their addresses. These persons were to be visited by inspecting Karkuns every day.

22,522. How was infection brought into Satara city?—From Karad, I think.

22,523. By human agency?—Yes.

22,524. And having regard to this fact, you think, I understand, that persons from infected localities should not be allowed to come to the limits of an uninfected locality?—Yes.

22,525. Putting on one side human agency, what other agency is there by which intection is carried from one village to another?—By the clothes of infected persons.

22,526. Have you any case where infection was clearly carried by clothes?—From Satara city infection was carried to Yawateshwar.

22,527. How did the clothes go there?—A Mahar was engaged where the dead bodies were to be burnt, and there was a report to the effect that he took clothes from the dead bodies to his relations on the hill, and by those means the plague was carried from Satara city to Yawateshwar.

22,528. Was that verified?—That is what was said, but it was verified also.

22,529. Could the Mahar not have caught plague himself?—That Mahar who carried these clothes did not catch plague.

22,530. Do you think that in an infected village rats may carry plague from house to house?—Yes, in Satara city I observed that. I saw from my own personal observation that rats carried infection from house to house.

22,531. Have you seen them going from house to house?—No; but if one house was infected the next neighbouring house was also infected.

22,532. When plague breaks out what do you think the most valuable remedy is?—Evacuation is the most successful remedy.

22,533. How long would you keep the people out after evacuation?—From my last experience I think that they should be asked to leave the town for four months.

22,534. If they went back to their houses sooner, what would happen?—Perhaps they would be attacked with plague.

22,535. Have you any instances where people went back within a shorter period and got plague?—Yes. I have instances of some disinfected houses, and as soon as they went back into those houses they were attacked with plague, and they died. The Jailer's house is an example.

22,536. We do not want a disinfected house, but one that has not been disinfected. We want to see how long the germ takes to die. You say four months; have you any instances of people who went back within a shorter period than four months to a house that had not been disinfected, and got plague?—I have no particular instance.

22,537. Why do you say four months?—The last particular time all the inhabitants of the city were out for four months; and afterwards they were allowed to go in. We did not notice any plague case occurring in the houses that were inhabited after four months.

22,538. What would you do with the patients?—According to the present Government orders they have to be segregated.

22,539. But what would you do with them?—If the house is well ventilated I would allow the person to remain in it.

22,540. Has that been tried at all?—No; because according to Government standing orders we were not at liberty to keep a patient in his house.

22,541. It is not within your experience whether it would be a dangerous course or not?—I could not get experience at that time, because we were not allowed to leave the patient in the house, although the houses were well ventilated.

22,542. Is the carrying away of the patient to the Plague Hospital offensive to the feelings of the people?—It is very offensive. In one case that came under my notice the patient, as soon as he was told that he was to be taken to the Plague Hospital, died. It was I who went to that patient and told him that the order was passed that he should be taken to the Plague Hospital. As soon as the ambulance came he was told that it had arrived, and he died.

22,543. If you leave the patient in the house what would you do with the rest of the people in the house?—I would allow one or two of his relations to attend on the patient, and the others I would ask to go into the segregation camp in the open air.

22,544. Would they object very much to that, do you think?—They would not object, I think, if the huts are well built and well ventilated.

22,545. How would you manage in the rains?—In the rains it is impossible.

22,546. What is your experience of disinfection of infected houses with chemicals?—I have no belief in disinfection, because it is very costly, and it cannot be properly done. The houses are not pucka built, and in the tiles and roofs, and other places, the germs will not be killed by disinfection.

22,547. What is your evidence of this?—Because many cases have re-occurred in houses which have been disinfected.

22,548. Are you quite sure that the chemicals were properly prepared?—There were special officers appointed to make the mixture, and I must assume that the chemicals were properly prepared.

22,549. Have you many actual instances where people returning to a disinfected house got plague?—Yes, I have about 10 cases.

22,550. Can you exclude the possibility of their having caught infection from some friends outside on the road, or from other houses?—They were not allowed to go into other houses.

22,551. Not after their return to their own houses?—Yes, after their return they were allowed; but they stealthily went to their houses without permission, and they died there.

22,552. But may they not have gone stealthily to other people's houses too?—I cannot say that.

22,553. You think, I understand, that poorly-fed people were, to a large extent, victims of plague?—Yes.

22,554. Do you think that plague is got much by touching plague patients?—No, because every day I used to visit the Plague Hospital, and touch the patients, and I never got plague.

22,555. But I suppose it is necessary to have boots, or something, on one's feet?—Yes, that is necessary.

22,556. Is sleeping on the ground dangerous?—Yes; sleeping on the ground is dangerous, even in the day or in the night: they got plague.

22,557. What are your views regarding the co-operation of the people, as being necessary for the successful carrying out of plague measures?—I believe that the people should be induced to act according to the wishes of Government. If they do not co-operate, then these measures will not come into proper operation. It is necessary that they should co-operate.

22,558. Is there any marked difference in the behaviour of the people now, as contrasted with their behaviour in the first epidemic?—Yes. As regards evacuation, last time, when they were asked to evacuate their houses, they were unwilling; but now that they have received their education with regard to plague, as soon as they see any infection is coming, they willingly leave their houses.

22,559. But do they understand the danger of their going back stealthily to their houses to sleep?—Some do, not all.

22,560. (*Mr. Hewett.*) Was it at about the worst period of the outbreak of plague that these ten cases occurred of people going back to disinfected houses, and getting plague?—No, it was not at all during the worst time; most of the cases occurred in February.

22,561. How many cases were there in February?—99 deaths.

22,562. There was then a considerable amount of plague in the place at the time?—Yes; there was a certain amount of plague in the place.

22,563. Are you a Municipal Commissioner?—I am a Municipal Commissioner; and, at that time, I was a Municipal Commissioner too.

22,564. Is there a byelaw of the Satara Municipal Committee which requires a householder to report every case of death in his house?—There is a byelaw that all persons are required to give information to the City Municipality within 72 hours after death. But that was not made with regard to plague.

22,565. I am not speaking about the plague, I am speaking about a byelaw before plague occurred?—There is a byelaw to that effect, that every person in whose house a death occurs, should give information to the Municipality within 72 hours, and if he does not give that information he will be liable to a fine of five rupees.

22,566. Has everybody in Satara always complied with this byelaw?—As regards death everybody complies with it.

22,567. Has any instance come to your notice in which it has not been complied with?—No. *Mr. V. G. Ghanekar.*

22,568. Every death since that byelaw was passed has been properly and punctually reported?—Yes. 28 Feb. 1899

22,569. Was the mortality rising when plague was detected here?—Yes, day by day it was rising.

22,570. Was the first case that was found out to be plague reported by the householder?—No.

22,571. How was that?—He could not say it was plague, the death only was reported.

22,572. Was the death reported?—Yes, the death was reported to the Municipality.

22,573. When a report is made that a death has occurred from a particular cause, does any medical officer examine the report?—No.

22,574. It is merely filed in the Municipal office?—Yes.

22,575. What is done with the reports of plague?—When a report comes to the Municipal office, then a Hospital Assistant is asked to examine the dead body, and if he says it is not plague, then the body is allowed to be taken to the burial ground. The register of deaths is kept at the Municipal office.

22,576. (*The President.*) You are in favour of allowing patients to be kept in their houses?—Yes.

22,577. In the case where you allow a patient to remain in his house, you allow some people, of course, to remain to look after the patient?—Yes.

22,578. How do you prevent visitors from outside coming in?—They should be asked not to come in.

22,579. There are no special means adopted?—No.

22,580. Do you not recognise that to be a possible danger?—As regards a well ventilated house, I do not see any possible danger.

22,581. You think it is quite safe?—Yes; and besides it is against our Hindu notions to take a patient away from his house to a Plague Hospital; our habits of living and our notions are against it.

22,582. One would not compel it to be done unless it were required, and if it came to be a public danger, habits would have to be set aside to some extent, would they not?—Yes, that is so.

22,583. Is it part of the difficulty that in the hospital they are isolated from their friends?—Yes.

22,584. Could that not be got over by allowing a certain number of their friends to come and see them just as if they were in their own houses?—That difficulty can be got over by allowing friends to see the patients in hospital, but when the patient himself is unwilling to go to hospital, how can the difficulty be got over?

22,585. Do you find that difficulty as great now as it was at the commencement of the epidemic?—The difficulty is still in existence.

22,586. You do remove certain patients?—Yes, we remove them, but they are unwilling.

22,587. You have a hospital, I think, for plague patients, have you not?—Yes.

22,588. And patients are taken there?—Yes.

22,589. Are they only the patients from houses where the accommodation is insufficient, do you think?—Almost all patients are taken.

22,590. You are not now adopting the plan of treating patients in their houses?—No.

22,591. Therefore, it is a practical measure, and you can carry it out?—Yes, we can.

(Witness withdrew.)

Lieutenant N. B. ANDERSON, I.S.C., called and examined. *Lieut. N. B. Anderson, I.S.C.*

22,592. (*The President.*) I believe you are in the Indian Staff Corps, and have had a good deal to do with plague work in Karachi and Satara?—Yes.

22,593. You are now engaged here?—Yes; I am Plague Supervising Officer.

22,594. (*Mr. Cumine.*) I will ask you about the Satara district first. How many infected villages have you now under your management?—Nineteen, spread over an area of about 1,000 square miles.

22,595. What do you think is the great remedy when a village is infected?—Entire evacuation, immediately.

22,596. When plague has regularly "caught on" in a village, do you find that partial evacuation is successful?—No.

22,597. When is it successful?—If there is a wadi some distance from the village, it might possibly not go to the village.

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22,598. I suppose if you take the epidemic early enough, when there have only been two or three cases, you might succeed with partial evacuation?—Yes; but I do not think so if a case occurred in the village proper.

22,599. Do you attach great importance to carrying out evacuation promptly?—Yes.

22,600. Does the duration of the epidemic depend upon the time the evacuation occupies?—Yes.

22,601. When, after evacuation, cases still keep going on amongst the evacuated people, after the expiry of the period of incubation, to what do you think that is traceable?—It is generally due to the people visiting their houses surreptitiously.

22,602. Supposing that the plague had been only in one corner of the village when the people went out, and after some time a man whose house is in the opposite corner goes back to his house, do you find that he is liable to get the plague?—He is practically certain to do so. Infection spreads through the emptied village just as it would do if people were there, only more slowly.

22,603. In cases where you leave a few human barometers in their houses in the villages, do you find those people especially liable, or do they escape?—I think they are especially liable to infection.

22,604. From the fact that cases keep on occurring amongst evacuated people in consequence of their surreptitiously visiting their houses, I suppose that evacuation must be accompanied by the preventing of people from visiting their evacuated houses, must it not?—Yes; all should be done that is possible to prevent them.

22,605. Do you find that with so many villages to manage you are able to do this in the case of each village?—Where there are good village officers, it can be done; but where there are not, it cannot be done.

22,606. Do you think evacuation is practicable in the rains?—No; I think not.

22,607. Even when you do evacuate in the rains, is there in the huts in which the evacuated people are living sufficient ventilation to prevent the plague "catching on" to the floor in the same way as it does in a house in the village?—I think the huts are frequently worse than the houses in the village.

22,608. In what way?—In being worse ventilated.

22,609. What is the result of that?—The result is that a large number in one hut will frequently get plague.

22,610. When the hut is apparently infected in that manner, what would you do with it?—Remove it to another place.

22,611. What is your opinion with regard to the effectiveness of disinfecting with liquid disinfectants—for instance, perchloride of mercury?—As it has been done it has been of no use.

22,612. How do you draw that deduction?—Cases have occurred in houses which have been disinfected.

22,613. Who prepared your perchloride of mercury for you?—I have not done any disinfection with perchloride of mercury here. It has been stopped during this cold weather.

22,614. Have you tried the kiln system of disinfection at all?—No.

22,615. You have had no experience of it?—No; but I burned the floors with grass in one village.

22,616. Have you any experience of inoculation in the Satara district?—None.

22,617. How do think plague is carried from one village to another?—I think, practically, it is always by human agency.

22,618. How do you think it is carried from one house to another within the same village?—By rats, and also it seems to travel of itself; there are very few rats in some villages.

22,619. Do you evacuate all villages as soon as they are found to be infected?—Yes; immediately.

22,620. But I suppose all villages become practically unevacuable in the rains, do they not?—Yes.

22,621. The effectiveness of evacuation depends to some extent upon the size of the village, does it not? For instance, you could not evacuate Bombay town?—No.

22,622. Does it depend also, to some extent, upon the employment of the inhabitants?—That sometimes adds to the difficulty of getting them out of the village.

22,623. In what way? Who are the most difficult to get out?—Brahmans, Banniahs, and Sahukars.

22,624. Have you noticed whether there is a specially high mortality amongst children just before an epidemic, or just after one?—I have not kept any figures with regard to it, but there has been a high mortality amongst children in several villages just before an outbreak of plague.

22,625. Have you noticed that the same villages are getting infected this year as were infected last year, or in the two previous years, or does the plague this year seem to choose villages it did not attack before?—It has attacked both.

22,626. You have nothing to observe upon the matter?—No. The plague shows no preference for one or the other.

22,627. Have you noticed any case in which there appears to have been a genuine recrudescence of the old germ within the village itself?—Not that could be called a recrudescence.

22,628. It has been re-infection?—Yes. Cases have occurred on paper as recrudescent, but they were not really so.

22,629. Do you do any corpse inspection?—Yes; in the larger villages it has been done.

22,630. Is it offensive to the feelings of the people?—Yes, I think it is.

22,631. Have you noticed whether there is any decrease in the virulence towards the end of an epidemic?—The epidemic is always finished up in the fields; but I think just as many people die amongst those who get plague as in the earlier stages; the proportion of deaths is not smaller.

22,632. Have you noticed whether swellings in the necks of children seem to occur to a remarkable extent after the close of an epidemic when plague is supposed to be extinct?—No, I have not noticed that.

22,633. Have any cases come under your observation of people getting plague twice?—None.

22,634. In the fair weather, amongst the evacuated people living in huts, do you find that if one plague case occurs in a hut it is liable to infect the neighbouring huts?—It does not follow; it occasionally occurs.

22,635. Which of the measures are people so convinced of the usefulness of, that they will adopt them themselves in the future?—Evacuation, certainly.

22,636. Do they do their best to keep out infectious strangers?—It depends on whether they have influence or not. A man with influence will get into the village.

22,637. Do they appreciate the danger of returning to sleep in their infected houses after they themselves have been evacuated?—I think they do, but they prefer to run the risk, and make sure that their goods are all safe.

22,638. Is there great difficulty in guarding their property in the empty village site?—There is a great deal.

22,639. Do you find that dacoities begin?—Yes, they do.

22,640. Do the people ever boycott those who insist on going to their houses and laying the rest of them open to re-infection?—No.

22,641. Do you find that they readily report the fact of their village being infected, or do they conceal it up to the last moment?—That entirely depends upon the village officers.

22,642. Have any cases come to your notice where they have sent off an express messenger to you to let you know of the first appearance of plague?—Yes, in one or two villages they have done so. The majority of the villages, however, do not do so.

22,643. Coming to Karachi, I believe you served there during the greater part of the first epidemic?—Yes.

22,644. And during the whole of the second?—Yes. In Karachi I was during the greater part of the first outbreak, and during the whole of the second, in charge of the Jail and Market Quarters which include the Joria Bazar, in which quarter the plague was more severe than elsewhere.

22,645. Were there any reasons for this?—There were, I think, three principal reasons for this:—

I. The plague originated in this part, and when it had become severe the inhabitants of other parts left before the full strength of the infection had time to reach there.

II. The Joria Bazar is the grain bazar of the city: and rats therefore abound in this neighbourhood in enormous numbers. No less than 105 were found dead in one house.

III. The narrowness of the streets and insanitary condition of the houses, especially the existence in them of wells and cesspools, which attracted the rats to them from the grain godowns.

22,646. Did the disease spread very rapidly in the Market Quarter?—In the Market Quarter the spread of the disease was exceedingly rapid, and was I believe conveyed entirely by rats, dead ones being found in almost every house in the quarter. The number (105) mentioned above was the largest found in any single house, but 75 were found in another and 65 in a third.

22,647. What reason had you to believe that rats moved about from one house to another?—In one or two houses where the walls were touching, I have seen them go from one house to another.

22,648. What reason have you to believe that they carried infection to human beings when they did go there?—Because cases have occurred in very many of these houses, and the first cases occurred where there were most rats, round the grain bazar.

22,649. How was it, in your opinion, that rats were enabled to spread the disease to such an extent?—That the rats were enabled to spread the disease to such an extent was due, I believe, to the insanitary condition of the houses and the wretched way in which they are built. In that portion of the Market Quarter in which the disease was most severe, the houses are mostly very old and built of mud plastered over a framework of sticks. Latterly, stone fronts have been built to some of them, but the house behind its imposing exterior remains the same as before. The foundations of these houses are saturated with sewage and filth of every description. There is generally a cesspool below the house which has not been emptied since the house was built and the neighbourhood of which is honeycombed with rat holes, and which is probably situated close to a well from which water is drawn for washing, if not for drinking purposes. This evil was aggravated by the narrowness of the streets and the scarcity of windows. The Municipality have followed a fatal policy of allowing householders to encroach upon the streets and selling them strips of land in front of their houses until it has been absolutely impossible to sell any more. Overcrowding, moreover, exists to a terrible extent, especially amongst the Meghwars (weavers), who are, I should imagine, the filthiest class of people in India. So dirty are they and such outcastes, that in their own country they used to be, and I am not sure are not still, branded each with the initial letter of his village, and wherever he may go he is never allowed to sleep within the limits of the town or village. It is, therefore, not surprising that the plague was so severe in this quarter. Any epidemic disease would, I think, be the same. It is a notable fact that in the really good houses, some of which were situated in the very heart of the most highly infected quarter, practically no cases occurred.

22,650. Did you notice in what kind of floors the plague seemed to flourish best?—Most of the floors were cow-dung floors. Houses with cemented and tiled floors did not suffer so badly.

22,651. Do you think that the drainage system of the town had anything to do with the excessive severity of the plague?—No, nothing whatever.

22,652. Does a drainage system really exist at all?—Only so far as carrying away dirty water from a very small percentage of the houses is concerned.

22,653. Are the houses connected with the sewers?—No, very few; perhaps some half dozen.

22,654. Has much been done in Karachi since the epidemic to improve the ventilation of the houses?—Yes, a very great deal.

22,655. What is the value, from your experience, of sleeping upon a bed as contrasted with sleeping on the floor?—People who sleep on beds run far less risk of catching plague, I think, than those who sleep on the floor. In one house in the Market Quarter everyone in the house got plague except one old man, who lay on the only bed.

22,656. Do you think that the people still have a great dread of the hospitals?—Yes, I do. There is, no doubt, that a very large number still have a dread of hospitals, especially Government Hospitals, and also of segregation, but the greatest dread of all is that of being carried away in stretchers, which is very genuine, and I think it is best never to use them at all.

22,657. Did you disinfect with perchloride of mercury in Karachi?—Yes: all the houses were disinfected.

22,658. Did you find it effective there?—No; cases occurred in some of the houses which had been disinfected, which were re-occupied; no further re-occupation was allowed.

22,659. Could you exclude the possibility of infection having been brought in again from some neighbour?—I think it was probably brought in by rats again.

22,660. So that you cannot say that disinfection did not perform its duty properly?—No; but if so, its effects were counteracted immediately afterwards.

22,661. Do you think that after a certain time the plague germ will die of itself without any disinfection?—Yes.

22,662. At what period do you put that?—Between three and four months.

22,663. Why do you select that particular period?—Because I have known people going back after nearly three months, and they have got the plague.

22,664. Do you find a shorter time is necessary in the extremely hot weather?—That I have not noticed.

22,665. Though disinfection may be of no use when there are a great many rats infected, and plague is very severe in a town, can you say it would not be of use where only two or three cases have occurred in a town?—No.

22,666. Do you think it would be useful then?—I think it might be useful then.

22,667. If you do not use disinfection to an infected house, what would you do to it?—Evacuation is all you can do. The entire disroofing of infected houses is by far the most effective measure. The opening of holes in the roof and walls, though it is doubtful, I think, if it has much effect at the time, forms, provided the openings are transformed into ventilators and windows, a vast permanent improvement.

22,668. What is your experience of inoculation at Karachi?—I had coolies working in my division, at a daily strength of about 50. Twenty cases of plague occurred amongst them up to the end of the first week in May. There were probably more, as more men disappeared; but there were certainly 20 cases which I was able to trace. I had half the men inoculated on the 7th of May and the other half a week later. One man developed high fever after he was inoculated, and died on the fifth day. After this, no case ever occurred amongst these men, who worked for two months subsequently in the most highly infected quarter of the town.

22,669. Are those the men who had already come unscathed through the plague, while the other 20 men died or disappeared?—Half of them would be; the other half would be fresh men.

22,670. Besides these coolies, have you any experience of inoculation of any other people in Karachi?—Yes.

22,671. Who?—Some 900 people living in my division were inoculated, and there was only one case among them.

22,672. But were those 900 people of all classes?—People of all classes. Some of them were actual contacts, and they did not get plague afterwards.

22,673. Were there amongst them representatives of classes amongst whom you think plague would probably come? Or did they all belong to the upper classes who would not be so likely to be infected?—They belonged to all classes; but many of them belonged to the Borahs and upper classes, who are less liable to be infected.

(Witness withdrew.)

Lieutenant H. C. STEEN, I.S.C., called and examined.

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22,674. (*The President.*) I believe you have been occupied in connection with plague matters at Satara?—Yes, in the southern part of the district.

22,675. You are a Staff Corps Officer, are you not?—Yes.

22,676. (*Mr. Hewett.*) How long have you been employed on plague duty in the Satara district?—Since the 19th of November, 1897.

22,677. Have you been continuously in the villages ever since that period at all seasons of the year?—Yes, I have been in the district ever since then.

22,678. Will you tell us what your experience has been as to the way in which a village gets infection?—I think it is almost entirely by the visits of people from infected villages to non-infected villages. I have had one case in which that has not been so.

22,679. When you say you have had one case in which it was not so, do you mean one case in which you were not able to establish that it was so?—I mean a case in which the infection was brought by other means.

22,680. Would you specify those other means?—It was supposed to have been brought to a village called Bambavda in the Valva taluka, by imported tobacco. A cartload of tobacco from Bhatavda, a neighbouring village, is said to have brought the infection.

22,681. Did you investigate this theory?—I was not there at the time, and I did not hear of it until afterwards. Dead rats were reported to have been found in the house, and three cases of plague occurred.

22,682. In the house to which tobacco had been brought?—Yes. Those three cases were amongst the first cases in that village.

22,683. How far is this village from the one from which tobacco was brought?—About two miles.

22,684. Was there any communication between the residents of the two villages?—I think there is communication between those villages.

22,685. What do you yourself think of the theory of communication by means of tobacco?—The theory is, I suppose: possible.

22,686. Do you attach any importance to it?—I do, provided infection can be imported by means of tobacco, in which case, this being the only theory of the infection of the village, I accept it in the absence of any other. In any case it appears that tobacco was brought from the infected village to a non-infected village.

22,687. And also that the plague occurred in the non-infected village?—Yes.

22,688. But do you think that it is impossible that plague got to the non-infected village by other means?—I think it is quite possible.

22,689. Have you a number of villages in which you have been able to trace the infection to people coming from infected villages?—Yes.

22,690. How many villages?—Seven villages at least. I have been able to trace it, more or less clearly, in about seven villages, and without doubt in one or two.

22,691. And you have had no village in which you have been able to clearly discover any other source of infection?—No.

22,692. Have you been able to trace any source of infection from clothes?—No.

22,693. Have you anything to say as to the part which rats play in disseminating plague?—Rats, I think there can be little doubt, disseminate the plague in a village, once the infection has been imported by human agency. Communication may exist, and probably often does, amongst the careless villagers, but when cases of plague are found occurring in totally different, and well separated, parts of a village, and amongst the highest and lowest castes, at the same time, there can, I think, be little doubt that the rats have spread the plague over the village, especially as large numbers of these vermin are, as a rule, found dead in the village, either before or at the same time as the occurrence of cases amongst the inhabitants. As a rule, they disseminated the plague in the village site very rapidly indeed, especially if it has been concealed, and little or no evacuation has taken place; but sometimes, as was the case in Islampur, which really forms one village with Uran, the plague develops slowly.

22,694. As a rule it has been your experience that you have found local cases of plague before you have found mortality among rats?—I have experienced both sets of circumstances.

22,695. Which is the more common?—I think rats dying first. There have been a good many cases of the other sort.

22,696. When you say rats dying first, do you mean rats dying between an imported case and a local case?—Yes.

22,697. Have you any instances in which you have moved people out of any infected portion of a village site, and then when the village has been re-occupied the people in another part of the village which was not infected at the time when it was evacuated have got the plague?—I have not had any examples of that.

22,698. Have you, as a rule, evacuated the villages in which plague has occurred?—Yes, always.

22,699. Even during the rainy season?—Yes.

22,700. Have you found any difficulty in doing so during the rainy season in this country?—It is very difficult, of course, during the rains, but I have generally got the people out.

22,701. Do you think that the people in the black cotton soil districts when they are turned out of their houses in the rains suffer considerable hardship?—Yes, I think they do. I can instance two villages especially, the village of Marul in Patan taluka and the village of Vathar in the Karad taluka. I used to visit the inhabitants of these villages after they had been evacuated, and go round their huts. They were suffering very great hardships indeed. They were all living more or less in mud. Some of them had good huts, but a great many of them had very uncomfortable huts.

22,702. Do you think that the hardship of living in huts during the rains led people to go back to their villages at nights?—It is quite possible. It is hard to say definitely what they do. Even if one seals the village, you find the seals broken. It is difficult to be certain in the majority of cases whether they go back or not.

22,703. Do you think that it is likely that they go back?—I think it is extremely likely that they go back. About the end of January 1898, in the village of Kale in Karad taluka, which had then been evacuated for about three months, I found, as the result of a night search that I made, considerably over a hundred persons surreptitiously sleeping in houses that had not been disinfected. Kale was, after Karad, the worst infected village in the taluka, and many cases of plague had occurred all over the village owing to the impossibility of evacuating it quickly in the rains. These persons may have been indulging in such practices for a considerable time, as the village was not sealed, but no fresh cases of plague were traced to them. The plague, in fact, had been dead at Kale for some weeks previous to the time that I made the search.

22,704. Did you find that when you evacuated people during the rains the plague took longer to bring under when the people were in the huts than it would if you had evacuated them in the dry season?—In the two instances I have named it did take a very long time. I have had other cases since then in which it took quite as long, if not longer, when the village was evacuated in the dry season.

22,705. But in both cases—both in wet and dry seasons—the establishment under your control does not enable you to be certain that the people do not get back to infected sites?—No, it does not.

22,706. How many infected villages have you to deal with at the present time?—Four villages in one taluka, and nine in another, about thirteen altogether, of which six are fully infected with plague, the other seven not being very bad.

22,707. Have you noticed a circumstance which Colonel Hay referred to yesterday, that villages on the banks of a river are especially liable to infection?—I noticed that in Valva taluka recently—last autumn. The fact is, that a very large proportion of the villages in that taluka are on the banks of the river, but I do not altogether connect the fact of their being on the banks of the river with the fact of their having become infected.

22,708. Have you resorted to disinfection in the villages?—I was doing that in Karad taluka shortly after I first arrived, and until I left there about six months afterwards.

22,709. What did you disinfect with?—With a solution of perchloride of mercury.

22,710. Do you do it now?—No, I have not been doing it since last July.

22,711. Is that in consequence of orders having been given to stop it?—No; orders were not given to stop it; but I was told to do it to a very much lesser extent. I made up my mind that it was not very much good, and so I practically did not do it at all.

22,712. Why do you think that it is of no use?—My experience of disinfection in Karad taluka first led me to doubt its value, but I do not feel competent to say that it is of no use. I did not begin until the villages had been evacuated for some considerable time. The shortest period was two months. In some cases I did not begin until they had been evacuated for five or even six months. In the meantime there had been a certain amount of re-occupation of those villages.

22,713. Is your reason for not believing in the efficacy of disinfection by perchloride of mercury that you think that the germ would be otherwise disposed of within a certain period, or that you think that the solution of perchloride of mercury cannot be efficiently used so as to destroy the infection throughout the house?—I think, in the first place, that the solution does not kill all the germs; in the second place if the village is left alone long enough the germs will probably disappear in some other way. My experience in Karad taluka tends to convince me that the germs did actually disappear somehow or other in a great many of the villages which I disinfected. I was led to believe that the germs had disappeared before disinfection was begun.

22,714. How long do you think that it takes for the germ to disappear?—I think two months is the least time.

22,715. Have you noticed that any of the villages have been infected in both epidemics?—Yes.

22,716. Are those villages which had been disinfected or had not been disinfected?—Villages which had been disinfected, and others also. It seems to take fresh villages more or less haphazard. When, however, the second epidemic began in the southern half of this district it attacked villages which had not been attacked before; but since then it has attacked others. No recrudescence of plague occurred in any of the disinfected villages in Karad taluka for months, and only then through re-importation. This seems to speak in favour of disinfection. At Andumbar Wadi, however, in Tasgaon taluka, which was disinfected under the "kiln-burning" process, but which was evacuated only six weeks, three fresh cases of plague at once occurred as the result of the inhabitants merely revisiting their houses.

22,717. Could it attack others by reason of infected people having come from infected villages?—It could, of course, and that is the probable reason; but it is impossible to be certain, as the people never, or seldom, assist such investigations. There is so much communication between the people that it is difficult to say what they do and where they go, and they practically never tell you. I think in nearly every case the infection of a village is due to re-importation.

22,718. You have not observed anything to lead you to believe in a recrudescence?—No, I do not think so. There has always been some story attached to the re-infection of a village to the effect that some man had come from some infected village, and in his house or in the adjoining houses cases have almost invariably occurred.

22,719. Have you observed a village which lies next to a village which was infected in the first epidemic get infected in the second epidemic while the village infected in the first epidemic escaped?—I have noticed instances of this, but consider it largely pure chance; though, at the same time, it is, I suppose, a likely theory, that the formerly infected village will be less susceptible to fresh infection than the one which has never been infected at all. Such a theory might be explained by the possible extermination or diminution of the rat community, as to which I have heard several affirmative opinions. It seems to me, however, purely a matter of what the people do, where they go, and what communications they have.

22,720. Did any of your disinfecting coolies get plague?—I did not have a single case of plague amongst my disinfecting coolies during the four months that I was engaged in disinfection work in Karad taluka, though, as I afterwards discovered, they were utterly careless of the possible risks they ran. I ascribe this immunity to the fact that, when I began disinfection, early in January, 1898, the first villages treated had been evacuated and partially unroofed for close on three months, while some of those taken in hand later had been evacuated four, five, and even six months. In fact, I came to the conclusion that the infection in these villages had somehow or other disappeared of itself, and that there was, therefore, none left to disinfect. Later, in July, 1898, when I sent the same coolies to Khanapur taluka to disinfect the small village of Upala-wangi, which, however, had only just got infected, their carelessness of the risks they ran resulted in no less than seven of them, out of twenty-four, being attacked with plague.

22,721. In what respect were the coolies careless?—I heard from the Hospital Assistant in charge that they had been particularly careless. I was a long way off and I had not visited them for some time. I heard they had been in the habit of buying clothes they found in the infected houses, and eating food similarly found, and, in fact, doing all sorts of careless things.

22,722. How long after that village had been evacuated was it that they went to disinfect it?—Less than a month, three weeks.

22,723. Have you recently, under your orders, tried disinfection by means of the kiln process?—Yes; it was tried in Tasgaon last August and September.

22,724. In how many villages was it tried?—It was tried in three wadis in Tasgaon taluka.

22,725. Did you employ the villagers themselves, or coolies, to do it?—I employed coolies permanently. When they had once learned the work they were more useful than other fresh coolies whom we should have had to be constantly teaching.

22,726. Who did the work?—Assistant-Surgeon Merchant personally supervised the work, I supervised the disinfection work generally.

22,727. Did you find that the coolies employed in disinfecting in this manner suffered?—The coolies must be careful, in whitewashing the dusty floor, not to raise the infected dust and so inoculate themselves with plague, a physically impossible task. A coolie with a whitewash brush first raises the dust, afterwards he may, or may not, whiten the floor. The coolies must also be careful to remove, without a doubt, the whole of the whitened top layer of the floor. When, however, they enter a room with picks and shovels, confusion at once reigns. The supposed dangerous top layer of the floor is cut up, flung about, mixed with lower layers, and the probability is that a very great deal of it is never removed from the house at all. For these reasons I consider the "kiln-burning" process a more dangerous one than that I employed. During the disinfection of three small wadies in Tasgaon taluka in September, 1898, four coolies died.

22,728. They exposed themselves to all sorts of risks, apparently?—Yes. My experience of coolies is that they are utterly careless.

22,729. Were the coolies as careless when they went to disinfect by means of the kiln process?—I fancy so. There was so much work on hand, and so many villages got infected at that time that I fancy they were left a good deal to themselves; they were always careless, and more so when not closely looked after.

22,730. How long after those three wadis had been disinfected by the kiln process were the people allowed to re-occupy them?—In the case of Andumbar wadi, it was six weeks, and in the case of Khandoba wadi a little over two months.

22,731. Did any case of plague occur in houses which had been disinfected in this way?—In Andumbar wadi three cases of plague occurred.

22,732. Were you able to trace the infection in this instance to any other place?—No; it was reported to me by Mr. Merchant, the Medical Officer in charge of operations, and he said that there was no evidence that infection had been imported in any other way. The people were allowed to revisit their houses for the purpose of cleaning them after disinfection, preparatory to re-occupation. Almost immediately, the same day or the next day, three cases of plague occurred amongst the people who had so revisited their houses.

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22,733. Do you infer from that that the kiln process was not efficient in this particular case?—It seemed to point so. I am not, however, prepared to say so definitely. It is just possible that there was some other reason for the occurrence of these three cases. One never knows what may have happened, what the people may have done. Some man may have gone to an infected village and returned.

22,734. Do you think that the tiling of houses is a desirable measure?—I cannot say whether it kills plague germs or not: but I think it is an advisable thing to ventilate a house in this or in some other way. A good many of the houses I have had to deal with have probably never had any ventilation for years. Mud-roofed houses, especially, are so constructed that it is almost impossible to ventilate the interior.

22,735. Have you had any experience with regard to the use of passes to try and check the movements of the people?—Yes; I have been issuing passes myself, and supervising the pass system, but I do not think they have ever been effectual. Hundreds and thousands of people are going about without passes every day. It is almost impossible to deal with these people except under a very complicated system of passes.

22,736. Do you think that the people in the villages understand evacuation; do they think it is a good measure against plague?—They only appreciate it after a certain point. In nearly every case they will stay in the village till the last moment. When plague gets very bad they will go out of their own account.

22,737. Do you think that when plague has got really bad in that manner that evacuation will stop it in a short time?—It must be prompt, otherwise the village population quickly become infected, and then evacuation does not stop the plague, but only diminishes it. The case of Uran is an example of this. In the rains, however, I was almost forced to the conclusion that evacuation was a failure, even to diminish an outbreak. The hardships and extreme discomfort to which the people are exposed in the cold, damp, and unhealthy fields seem to render them so susceptible to infection, that they readily fall victims in large number to any plague that may be about. Vathar and Marul in Karad and Patan talukas respectively are good examples of this. Both villages were evacuated in very bad weather, and necessarily slowly; in the former village almost 20 per cent. of the population was exterminated. Subsequent experience, however, went to prove that even in the rains evacuation is better that non-evacuation. The village of Atke in Karad taluka became infected in September last year, when the rains were exceptionally heavy. The inhabitants could not be induced to evacuate the village, with the result that the daily attacks so increased that six or seven were common, a state of things were common, a state of things worse than prevailed at Vathar at any time. Atke is, however, a good example of where, plague being severe, complete evacuation stopped it. During the first half of October the plague was at its height. On the 14th of that month the village was completely evacuated, and by the end of the month the plague had almost completely died away. The village of Takari in Valva taluka is another, though not so good. Plague broke out on 4th October 1898. The plague was concealed for some time, but by the 14th the village was completely evacuated and by the end of the month the plague had stopped entirely. The village of Padmal in Tasgaon taluka is a good example of where, plague having been discovered early, complete evacuation stopped the outbreak in a few days. Plague appeared in the village on the 22nd June 1898. By the morning of the 23rd it was completely evacuated, and after six cases had occurred the epidemic stopped. This village also well evidences the fact of the locality being infected. On the 29th June disinfection was begun, the people had necessarily to revisit their houses, and on the 4th July the plague began again, resulting in 30 fresh cases. But the village of Ashta in Valva taluka bids fair to be the best example of all of the value of evacuation in stopping an incipient epidemic. Two cases of plague occurred in the very middle of this large and hitherto uninfected town on the 16th December 1898. On the 17th and 18th a large block was evacuated, which by the 23rd was extended so as to include no less than 90 houses. Four cases have occurred amongst the inmates of the first and an adjoining house, but with these the epidemic appears to have ended. There is little doubt, however, that two or three houses are infected, and so the whole block is rigorously sealed, and no disinfection or other interference with any of the evacuated houses is permitted.

22,738. Please give us the facts as regards Uran?—The outbreak was first discovered on the 25th of September; the infection was supposed to have been imported about five days before, about the 20th.

22,739. Did you evacuate the whole village then?—I evacuated it by large blocks. It was all evacuated by the middle of October.

22,740. Is plague still in existence there?—There is an odd case from time to time even now.

22,741. When was plague at its worst there in the interval between evacuation and the present time?—It was at its worst during the whole of October and November. During both those months plague was very bad.

22,742. Practically it continued to be very bad for two months after it started?—From about the beginning of October till very nearly the middle of December.

22,743. Have you anything to say as regards segregation of the sick and contacts in villages?—Segregation of all sick and contacts in a particular place ought to be an excellent measure for a village, provided it is thorough, as in this way the infection will be gradually weeded out of a community until the epidemic stops. But for carrying out this measure thoroughly at a large number of infected villages resources must be ample. I have been engaged in this work for over a year now, but am afraid I cannot say much for the results. My resources were necessarily limited, and in fact the arrangements have been practically in the hands of the people themselves. They are of the following rough and ready description. I choose a suitable piece of ground, and order the infected families to live there for the required time, building their own huts, as they refuse to live in huts erected for them. They are required to make proper arrangements for comfortable residence during their stay. I allow the patient and one attendant to remain behind in the fields. Separate camps, and sometimes even separate huts, for sick and contacts have been found impossible, as families are, as a rule, too small to admit of being broken up. An instance of the latter is where a family consists of a man, his wife, and two or three very small children. If the mother gets attacked with plague, the husband attends on her, and the children cannot be separated from their mother. Consequently the whole family live together in the same hut. Such cases are common.

22,744. (*Mr. Cumine.*) I believe you have only six villages infected now?—That is about the number of the *badly* infected villages; the total number of infected villages in my charge is more than double that.

22,745. What is the approximate area that they cover?—Thirty-five miles long, by about ten miles broad.

22,746. During the rains I suppose the people, in order to make themselves comfortable in their huts, have to close up the huts almost as much as their houses in the village?—Yes, they have to keep out the rains and so the top part of the hut must be more or less watertight. The door of the hut, when there is one, is almost always open. I consider that there is always more ventilation in the huts than in most of the mud roofed houses. There is sometimes a door to the hut, which is practically never closed, and would not make much difference if it were, as it is generally of loose construction.

22,747. Have you done anything in the way of corpse inspection in the villages?—Yes, I have inspected corpses myself; and they are always inspected either by the village officers, or the Circle Inspectors.

22,748. Is the inspection of female corpses offensive to the feelings of the villagers?—I do not think so, as I have never had any trouble on this head except with gosha families.

22,749. Though the people may not have made any actual opposition, have you any reason to suppose that it is offensive to their feelings?—No, as a rule I do not think it is. They show their corpses quite freely, both male and female. Before death, also, I have often examined both male and female patients, and have never noticed that my doing so was offensive to their relatives. The people are often quite callous as to what is done with their sick and dead.

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22,750. Have you ever tried treating patients in their houses, instead of removing them to hospital?—No; I have had very few patients left in the houses, occasionally one or two. The village has always been evacuated more or less promptly, and most of the cases have occurred in the fields.

22,751. Have you noticed whether an excessive mortality amongst children precedes or follows an outbreak of plague in a village?—No; I cannot say that I have.

22,752. (*The President.*) What is the population of the village of Uran?—About 6,000.

22,753. I understood you to say that plague had been developed for several weeks before evacuation was attempted?—No, I did not mean to say that, if I did.

22,754. After evacuation, do you mean to say that the development was not checked, but rather increased?—I cannot say to what extent the plague would have developed if the village had not been evacuated, but considering that two, three, four, and even five and six cases of plague occurred daily in the fields for no less than six weeks or so after evacuation had been completed, the extent to which this measure checked the development of the epidemic can hardly be said to have been marked.

22,755. When was evacuation commenced?—The infected house was at once evacuated.

22,756. On the same day the first case was discovered?—Yes.

22,757. How long did evacuation continue before it was completed?—For about a fortnight.

22,758. That would be early in October?—Towards the middle of October.

22,759. Prior to this period in the middle of October how many cases had occurred?—I think only four in the village, but upwards of 50 in all in the village and fields, I will not be absolutely certain.

22,760. It was a small number?—Yes, inside half-a-dozen in the village only.

22,761. After evacuation was accomplished in the middle of October, how many cases occurred among those people who were evacuated?—I think upwards of 200, if not more than that.

22,762. Where were they evacuated to?—Into the fields. Each man went to his own field.

22,763. What house or hut did he go to?—Each man erected his own hut in his own field.

22,764. Did he construct the hut inside or outside the village?—He constructed his hut outside the village.

22,765. Under what directions or superintendence?—His own.

22,766. He put it wherever it liked?—Yes, in his own field.

22,767. In the open country?—Yes.

22,768. As near any other hut as he pleased?—Yes.

22,769. Were any directions given as to there being sufficient air space in these huts?—No.

22,770. As a matter of fact was there any ventilation?—There was a certain amount of ventilation through these huts, by the doors, and their loose construction generally.

22,771. Is there more than one door?—As a rule there is only one door, but in some cases there are two doors. In the majority of cases, however, there is only the door space, but no door. When the door space is required to be closed, a blanket is hung across it.

22,772. Of what material are the doors made?—The same material as the huts, karbi.

22,773. Were the doors kept open all night or shut?—I cannot say for certain, though as a rule, they were probably kept open. The majority of the huts were however doorless. A certain number of the huts had loose doors.

22,774. Do you know whether the huts were ever overcrowded or not?—I think in the majority of cases they are generally pretty full of occupants.

22,775. Overcrowded?—Yes.

22,776. Was any precaution taken to prevent communication between those people who had gone out, or who had been removed, and the villages or houses from which they had been removed?—The doors of the houses were sealed.

22,777. Did the people go back?—Many seals were broken, and so possibly some did go back, but as they were never found living in the village, except perhaps an odd family or so, those who did go back can only have paid a hasty visit. No considerable number ever went back and stayed.

22,778. The probability is that they did go back because these houses would not be broken into by other people, there are not so many burglars?—Most of the seals were broken by children and mischievous people. I several times found that the seals on the doors of the compounds were broken, while the seals of the houses themselves were intact.

22,779. Were there many such cases?—Yes, a great many were like this. The evidence clearly pointed that the seals had been broken by mischievous persons.

22,780. You examined a good many houses and found this out?—Yes, I examined the villages regularly after evacuation.

22,781. And in nearly all these cases the outside seals had been broken, while the inside seals remained intact?—Yes; in the large majority of cases. The inside seal was not broken, but the seal on the large outside door leading into the courtyard was broken. Children and other mischievous persons did not seem to care to take the trouble to climb over walls for the purpose of breaking the inside seals.

22,782. The actual living rooms could not be entered without breaking the seals?—No.

22,783. Were there any windows by means of which the rooms could be entered?—Practically none.

22,784. I suppose in a certain number of these cases of seal-breaking, it was not done with mischievous intent?—In a certain number of cases it might have been done out of spite The people knew generally that if seals were broken somebody would be punished. If a man had an enemy he would probably break the seal on his door.

22,785. Do you attribute any of the seal-breaking to the people themselves attempting to go into their houses?—I think only a very small proportion, if any, was due to this cause, the majority of cases were, apparently, due to either mischief or spite.

22,786. Can you tell me whether, in your opinion, in any instance whatever the people went back into these houses?—In a very few, odd instances, I have found persons paying temporary visits to their houses, and in an equally small number of cases I have found persons come back to stay.

22,787. From the precautions which you took can you say with confidence that they never did go back?—No, I cannot.

(Witness withdrew.)

(Adjourned till Wednesday, 1st March, at Belgaum.)

At The Collector's Office, Belgaum.

FIFTY-EIGHTH DAY.

Wednesday, 1st March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. C. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. G. Carmichael, I.C.S.

1 March 1899.

Mr. G. CARMICHAEL, I.C.S., called and examined.

22,788. (*The President.*) You are the Collector of Belgaum?—Yes.

22,789. You have had experience of plague in Sholapur, Kaira, and Belgaum?—Yes.

22,790. In regard to Sholapur, at what time did you have experience of plague?—In September 1897.

22,791. Were you there long?—I was only there for a month and a half after the plague began, and then I was transferred.

22,792. You cannot say much about it?—No.

22,793. Do you know how it originated in Sholapur?—I think that it was brought by Mr. Thatcher's servant.

22,794. Did you leave before the epidemic had ceased?—Yes.

22,795. Can you tell us, generally, what were the measures adopted while you were there?—Evacuation was not attempted, and we only tried to prevent the people from leaving Sholapur. We took the sick to hospital, and then the segregation camp was started.

22,796. While you were there, was the epidemic being brought down markedly?—Oh, no, it was going up rapidly.

22,797. The measures that you speak of do not appear to have been effective?—They were not effective.

22,798. With regard to Belgaum, is your experience only of the city, or of the cantonment and the city?—Only of the city.

22,799. Did you see both epidemics?—No, I came at the height of the second epidemic only.

22,800. Do you know how it originated?—In the city it began on the outskirts next the cantonment. There is nothing in between the city and the cantonment but a ditch and a wall. All the streets on the side of the city next the cantonment were first infected.

22,801. What did you infer from that?—That rats carried it from one to the other.

22,802. Was the city infected from the cantonment?—Yes.

22,803. At what date did the second epidemic begin?—It began about August 1898. There were a few cases in July. It has not really been clear, except for about four weeks after the first epidemic. It has not been quite clear, without a single case, for a whole month.

22,804. You think it was spread by rats?—I think it was brought over from the cantonment by rats, and also by the people, because we could not keep the people from the cantonment out of the town. From the fact that so many cases in the beginning occurred in the streets next the cantonment, I thought that not the people only, but the rats carried it over.

22,805. Were there many dead rats found in the city during the previous epidemic?—There were, but I cannot say from personal knowledge, as I was not here at that time.

22,806. That was in the rainy season?—Yes.

22,807. What were the measures which you adopted?—When I came here the people were left in their houses, and the only measures that were being carried out was disinfection of houses, and disinfection of burial parties.

22,808. Were the people segregated?—The people were not segregated, except for the time it was necessary to disinfect their houses. After their houses had been disinfected, and their clothes disinfected, they were allowed to go back to their houses again, and the sick were not removed to hospital unless they went voluntarily.

22,809. What time did that occupy?—From one to two days at most.

22,810. Did the sick generally live in houses with more than one room?—It was the usual house here, a long, deep, narrow house, with doors at the narrow ends. There are usually three rooms in it, each opening into the other. The two outside rooms have doors, the middle one being quite dark, with no windows.

22,811. So that they were able to move a patient to one of the other rooms while the room that had been occupied by the sick person was disinfected?—Yes.

22,812. Was that done?—Of course they were kept in one of the rooms, but you could not possibly keep the people separate.

22,813. While disinfection was going on, what was done with the people in the house?—They were taken to the segregation camp, and there their clothes were disinfected, and meantime the house and everything in the house was disinfected.

22,814. You say the people who were not infected in this house were removed to the camp?—Yes, the people who were not patients.

22,815. What about the patients?—The patient was left in the house, and the people were left in the house until he had either died or recovered.

22,816. In the meantime no disinfection was done?—No, that was done afterwards. If you had several cases occurring one after the other, sometimes it was a fortnight before the disinfection was done.

22,817. Was any special means taken to prevent communication from outsiders with this house?—We tried to do it, but it was of very little good.

22,818. What were the means?—Only advising the people not to leave the house.

22,819. There was nothing like a cordon?—No.

22,820. Was that effective in keeping the people from going into the house, or not?—No, I do not think so.

22,821. As a general result, were those measures successful or not successful?—We had a large death-rate, but I do not know that we had a larger death-rate than we would have had if we had segregated the people.

22,822. You did not segregate the people, but as a matter of fact did the plague go on growing, or did it not increase?—It went on growing. In October it went up to 60 attacks and 50 deaths for one or two days, and then it went down.

22,823. Whatever your method was, it failed to stop the epidemic?—Yes.

22,824. Did the epidemic continue into the dry weather?—It continued into the dry weather. Of course we persuaded a large number of people to go out, and at the end of the year there were only about 18,000 people in the town out of a population of 30,000.

22,825. Did the epidemic still continue?—Yes, we were still getting occasional cases here and there in the town, about three a week or four a week.

22,826. What was done with the people who went out? Did they go where they liked, or was there any kind of regulation as to where they should go?—We helped them to build huts in different places round the town, and they went out into them.

22,827. In certain prescribed places?—We helped them to select places.

22,828. Were there fewer cases among those who went out than among those who remained in?—There were.

22,829. How did you disinfect?—We disinfected with perchloride of mercury. We had disinfecting gangs who opened up the house and sprinkled the whole of the walls and floors with the solution, and steeped the clothes in the tub of perchloride of mercury, and then swept out the house and burnt up all the rubbish outside.

22,830. That was only the infected house?—In one or two cases we did the streets, whether the house had a plague case or not, but we did not attempt to do it all over the town. In the other part of the town we only did it in houses where plague cases had occurred.

22,831. In that one street did you remove the people altogether, or what did you do with them?—They went out. I ordered it to be evacuated.

22,832. How long did they generally stay out?—Many of them are out still.

22,833. There is no rule in the matter?—No.

22,834. Within what time might they return to Belgaum? Would any of them come back within a few days, or did they all stay out?—I cannot say definitely. Once they go out they all stay out, except the weavers, who get permission to come in and work in their houses in the daytime but not to sleep in them.

22,835. Do you know of any cases in which a disinfected house having become re-occupied has become again an infected house?—We have had several cases of that.

22,836. Can you give us an instance?—I cannot quote you an instance, but I think there are several stated in Mr. Uchgaonkar's précis of evidence.

22,837. At any rate, you know they did occur?—Yes.

22,838. You also did a good deal of inoculation with Haffkine's fluid?—That was done before my time, practically at the beginning of the first epidemic it was done. In December and January most of it was done.

22,839. That was before you came here?—Yes.

22,840. Have you no personal knowledge of it?—No, but I know the way they collected the statistics. Mr. Uchgaonkar has given the inoculation statistics in his précis of evidence.

22,841. Have you any opinion as to how long a village ought to be evacuated?—I cannot make a rule as to the time of it, but about three months after the last case, if possible.

22,842. You have not sufficient grounds to go on?—I have only dealt with one or two villages yet. It is only three months after the rains, and we could not evacuate during the rains.

22,843. I think you state in your précis that after that period of three months re-entering the house appears to have been safe?—If the house had been ventilated and thoroughly cleaned out.

22,844. That is only an opinion, you have no reasons for it?—I cannot give you any facts except judging from the villages that have had an epidemic, and it has passed over in the rains without any evacuation.

22,845. The epidemic ceased in those villages?—Yes, without anything being done; without much evacuation, and, in some cases, without any evacuation.

22,846. You have some cases without any evacuation, and without any disinfection?—Yes.

22,847. Do you remember those cases?—Neginhal was one instance.

22,848. What is the population of that village?—2,949. It was infected on the 21st July 1898, and the disease died out at the end of September.

22,849. How many cases were there?—496 cases and 391 deaths.

22,850. When this large number of plague cases was occurring, did the people not remove themselves from the village?—Some of them did.

22,851. To a large extent?—About half of them went out.

22,852. Therefore you had about 496 cases among 1,500 people?—I do not say that those that went out did not get cases.

22,853. They may have got cases?—Yes.

22,854. Do you know where they went to?—They went into huts round the village site.

22,855. Are you sure that they did not go to other villages?—Some of them may have done so; probably a few did.

22,856. Not a large proportion?—Not a large proportion of the whole.

22,857. Had you any means of knowing that—I mean by a census of the people who had gone out?—A census was kept by the Supervisor.

22,858. In the camp?—No, in the village. He made a census of the village.

22,859. I am talking of the people who left the village?—I am talking of the village as a whole, not of the village site. We make a census of the villagers, and those that leave have to get permission from the subordinate officer in charge of the operations there. In his daily statement he puts down how many people left the village, and we have to depend upon him.

22,860. It is recorded?—Yes.

22,861. Can you give us the number of villagers who went into other villages?—54 families, or, say, 300 people at most.

22,862. I suppose your view is not, however, that an infected village ought to be left to itself?—No, I do not think so.

22,863. If an infected village is left alone, experience shows that it suffers a very high mortality?—Yes.

22,864. What are your views about the importance of disinfection?—Disinfection with perchloride of mercury I do not think has much effect, except that it cleans out the house and airs it out for the time being, but if it is shut up afterwards it is just as likely to get infected by rats as it was before.

22,865. I asked you if you had instances in a town of where houses were re-occupied after disinfection. That would be the proof?—It is no proof, because we cannot tell where the infection was caught, whether it was in the town, or whether it was caught elsewhere, or in the house.

22,866. Why do you think disinfection was not effective, and that it was of no value?—It was done so much in the jail, and it did not stop the disease there.

22,867. Would you tell me the facts that came under your observation of what happened with regard to plague in the jail?—We first had a case on the 17th November. The man was found sick one morning and died at 9 o'clock at night, and two days after that we had another case. We had 10 cases altogether—four deaths and six recoveries.

22,868. Would you tell me how that bears on disinfection? You have not referred to that yet?—After each case we disinfected the whole of the jail. It is a small jail, and the clothes and everything about the prisoners were disinfected.

22,869. Nevertheless you had a succession of cases following each other?—We kept on getting cases.

22,870. Within what time did these cases occur?—The most of them occurred within one month, and then there were two isolated ones—after we had inoculated a good number—at the end of December and the middle of January. In the meantime the prisoners, after a week in the jail where they got the plague first, were removed to the small Civil jail, and some of them got it there.

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22,871. Did many of these cases occur in the small Civil jail, or nearly all?—The first case was on the 17th. There were two cases on the 18th, two on the 20th, one on the 22nd, one on the 24th November. These were all in November.

22,872. But why do you think that is a case proving that disinfection was of no use?—We disinfected every day the whole of the wards.

22,873. You have given me seven at least out of these 10, which all occurred within the incubation period. They might have been all infected at the same moment. There were only three left, which may have occurred in the other jail?—The next one was on the 1st December, and the next on the 23rd December. When the jail was vacated we moved into the new one on the 26th December.

22,874. The last case that occurred in the small Civil jail had nothing to do with the disinfection which you carried out in the other jail?—No.

22,875. Do you think it is important to disinfect clothing or other movables?—Yes, I think it is of great importance.

22,876. Have you any proof that it is of great value?—No, I do not think I can give any case.

22,877. It is just an opinion?—Yes.

22,878. You state in your précis that you think that clothes carry the infection. Have you any cases that seem to show that?—There is a case at Ugargol. There were six cases all in one house on the 2nd of October, and the man had come from Dharwar in the middle of August, and he had not gone back to Dharwar, as far as I could ascertain.

22,879. I do not quite see how the clothes carried the infection in this case?—It could not be incubating all the time. I say the usual way in which the villagers are infected is that some of them bring in infected clothes or other articles into the villages. It is not necessarily incubating on the man himself when he comes to the village.

22,880. Can you give us examples of clothes or other articles, apart from a human being, having brought plague?—I cannot mention any particular article that brought it.

22,881. How do you separate the person from the article?—Because plague is said to incubate at 10 days. If you had a man who was living in a village for a month—if he is going to have plague—if he conveyed the bacillus in his person—it would have come out and he would have had plague before.

22,882. I do not quite understand how that applies to this case?—This man came to Ugargol from Dharwar, which was, at that time, infected with plague.

22,883. When did plague occur in Ugargol?—He went to Dharwar on the 2nd of August. He came back in the middle of August, and the case occurred on the 2nd October—a month and a half afterwards.

22,884. But were not there other opportunities for infection?—That was the only infected village at all. It was the first infected in that part.

22,885. You think this shows be carried some article which was infected?—Yes, I think so.

22,886. Have you any other cases?—Then there is the case of Yedur. Dead rats were found in a coolie's house. That was the first intimation that plague was in this part of the village. The coolie himself did not die or any of his family until 15 days after the dead rats were found.

22,887. You think the rats were the cause of it?—I think rats got it first before human beings got it.

22,888. How do you think the infection originated in the house?—The man must have gone to some other village and infected the rats.

22,889. Do you know of your own knowledge of any inoculated persons acquiring plague?—Yes; there was the case of two persons in the jail.

22,890. Have you any others?—I cannot vouch for others.

22,891. What is your view as to the best measures to adopt? What, in your experience, is the most effective step to take when plague has occurred in a district or village?—For the people to go out and evacuate a village.

22,892. You have said you do not think disinfection was sufficient?—I think disinfection is a very good thing in dealing with imported cases, and segregation also. If you have an imported case, before plague had spread in a village, I think disinfection is good.

22,893. There are two kinds of conditions in the villages: one is where the village is largely infected—where there is a large number of cases in that village, then you think the best plan is evacuation?—Yes.

22,894. And on the other hand, where you have only one or two cases?—If they are indigenous, it does not matter—evacuation still is the only hope of saving the place.

22,895. If they are not explainable by importation, then you also think evacuation is necessary?—Yes.

22,896. But, if they are explained by importation, what would you do?—I would have the man out and disinfect his house thoroughly.

22,897. On what theory do you draw the distinction?—I think it is spread by rats. If the rats in the village are not infected, and if they do not get the plague in houses in which imported cases occur, then it is not likely to spread to the village.

22,898. You do not know of any case occurring in a village in which there was no mortality among the rats?—No, not as far as I know.

22,899. (*Mr. Hewett.*) In Sholapur was there a byelaw for the registration of deaths?—Yes.

22,900. Did the Municipal Committee carry out the byelaw thoroughly?—I do not think so.

22,901. Is there a similar byelaw in the Belgaum Municipality?—There is.

22,902. Can you give us an estimate of the proportion of the population who ran away from Belgaum city during the second outbreak?—I am afraid I could not give you an estimate of those who ran away.

22,903. Do you think that many ran away?—Not a large proportion of them. At the beginning of the first epidemic there were a lot of strangers.

22,904. At the beginning of the first epidemic you had a large extra population?—Yes, I believe so.

22,905. What proportion of the population here at the beginning of the first epidemic ran away?—Less than one-fourth, I should think.

22,906. What I want to try and make out is, whether in your opinion a larger proportion of the population ran away during the first epidemic than in the second epidemic?—I do not know—I could not say.

22,907. Do you think that the fact that rigorous measures were not taken during the second epidemic encouraged the people to stay in the town rather than to run away?—Yes, in the case of the poorer people.

22,908. Could you state exactly when you first began to be able to get the people out of the town during the second epidemic?—It was well into November before we got an appreciable number out.

22,909. Was the disease on the decline when you got them out?—Yes, it was going down. The highest month was October and part of November.

22,910. By the time you were able to get them out, the disease had begun to decline somewhat rapidly?—Yes, of itself. The fall was comparatively rapid in November.

22,911. Could you state the number of villages which are infected in your district at the present time?—About 60.

22,912. Are they scattered all over the district?—They are mostly in the south.

22,913. How many European officers are employed on plague duty in the villages at present?—Six.

22,914. With that number can you insist on the effective carrying out of the measure of evacuation under European supervision in each individual village?—It is enough if we have good circle men under them. They instruct the circle men, and the circle officers go round.

22,915. Do you regard any agency except European agency as really reliable in the matter of evacuating a village, and seeing that people do not get back to the village site?—I think it is necessary; I do not think native agency is sufficient.

22,916. I suppose these European officers who are working the district have to move long distances from one infected village to another?—Yes, they have.

22,917. In addition to the villages which are now infected, you have had a large number infected at different times; could you give us a statement to show the number that have been infected in each month from the beginning up to February?—(The following statement was subsequently supplied by witness):—

	Villages.
Newly infected in 1897:—	
November	3
December	1
Newly infected in 1898:—	
January	12
February	8
March	8
April	3
May	3
June	5
July	7
August	28
September	33
October	37
November	34
December	27
Newly infected in 1899:—	
January	22
February	21

22,918. When did the villages in your district begin to be infected?—In January and February 1898.

22,919. Have certain portions of the district remained continuously infected ever since then?—Yes; certain portions of the district have always been infected since then.

22,920. Do you think that the evacuation of a village in the Belgaum district is accompanied during the rainy season with great hardship to the people who have to be evacuated?—I think it is a very great hardship.

22,921. Do you think that the hardship involved in evacuation is likely to make the people more liable to other kinds of illness; I am speaking of exposure in the rains?—I know that the Deputy Collector reported that the health of the only village which did evacuate during the rains was good.

22,922. Is it your opinion, the infection having been brought to a particular area by either a person, or clothes, or other effects, the person himself not being infected, that the disease passes into the rats, and that it takes some little time for it to become localized among the human beings of the place?—Yes, I think so.

22,923. I see from a report made by the Superintendent of the jail, that he seemed to connect the outbreak in it with the fact that the first man who got plague had been taken out from the jail to be placed under trial?—Yes.

22,924. Why do you think that this was not the method in which the jail became infected?—Other prisoners began to get plague immediately after the man was infected; and dead rats were found before. I cannot say that for certain: that is my impression.

22,925. The Superintendent says that the first one was found on the 19th; do you think they were found earlier than that?—I believe they were; but I have no proof of that. I only know that they removed the grain to a different place from where the rats were found. Shortly before, I believe, rats were dying, and they removed the grain; but they did not report it.

22,926. Was there plague in Gokak at the time?—Yes.

22,927. How far from the jail was plague in existence at the time in Belgaum?—The jail is on the top of the hill, about 300 yards from the nearest house in the town where there was plague.

22,928. Was there any plague among the warders in the jail?—No, I do not think there was. None of the warders took it. The jailer was living in the corner of the jail. He moved his family shortly before the outbreak—about the same time as the grain was removed.

22,929. I believe you were going to say something about the statistics of inoculation which have been separately furnished to the Commission. The statistics that have been prepared were prepared under your general directions, were they not?—Yes, under the directions of Colonel Peters, I.M.S., and myself.

22,930. Could you describe the manner in which they were prepared?—The record is not very complete. It is very difficult to identify the inoculated people in several cases, because there was often a single name entered, and very little else. A certain proportion is like that. In other cases the name, the number of the house, and the occupation of the person are entered in our Inoculation Register. They are arranged alphabetically; and we went over our Attack Register and Death Register and checked the names. That is the way we did it.

22,931. Did the Attack and Death Register contain any particulars beyond the actual names of persons who died?—It gives the streets and houses; and it also is supposed to say whether a man was inoculated or not. That, however, has not always been given.

22,932. Has it sometimes happened that nothing but the name of the person inoculated has been entered in the register of inoculated persons?—That has occurred in some cases.

22,933. In what proportion of cases did you find only the name?—I could not say.

22,934. Would the proportion be sufficiently large to seriously affect the results?—No, I do not think so. Most of those without names were the servants of gentlemen who were not living in the cantonment, and people in the cantonment.

22,935. When you say that you have only heard of two inoculated persons acquiring plague, I understand you to mean two who have come under your personal observation?—Yes.

22,936. But you know that a considerable number died of plague?—Yes. There was the case of a man who came to a village in Parasgad taluka. He had been twice inoculated and he died. He came from Dharwar.

22,937. The villages now infected are in the south portion of your district?—Yes, mostly on the south side.

22,938. Adjoining what district?—Adjoining Dharwar.

22,939. Do you attribute the infection of the talukas at present infected to infection from your own district or from another district?—Partly from our own, and and partly from other districts. There are a lot of natives from the Native States. We have part of Sangli State in the centre of the suburbs of the Municipality.

22,940. Do you think that in order to make plague measures effective, it is essential that you should have the people on your side?—I certainly think so.

22,941. Do the people generally in your district recognize the benefits of any particular measures that are taken to suppress plague?—I think they do now.

22,942. What particular measure do you think they recognize as being useful?—They evacuate the villages of their own accord when they find rats. They do not understand why they should clean their clothes, and disinfect their clothes. It is very difficult to make them understand that.

22,943. But they do understand that they should leave a plague infected site?—Yes. Rats were found in the village of Holihosur in December; the people went out for a whole month, and they had no plague case until, I suppose, they thought they were safe, and some of them went back. We are having a few cases there now.

22,944. (*The President.*) I think you expressed the opinion that early information of plague cases was very important?—I certainly think so.

22,945. Do you think it is of primary importance?—Yes.

22,946. Otherwise, the alternative which you mentioned to removing the people is of no benefit; you cannot find out imported cases?—No.

22,947. If you always had early information, you would always be able to deal sufficiently early with imported cases?—Yes.

22,948. And, therefore, all other measures would be unnecessary, according to your views?—Yes; but my point is, that you cannot get information in many of the cases because the people do not know.

22,949. Have you any suggestion to make by which early information could be obtained as a practical measure?—I do not think you can get it. Very often you cannot tell whether a village has been infected, because it is infected before deaths occur and before sickness occurs.

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22,950. Do you mean that you cannot know until it is very strongly infected?—It may be infected without your knowing it, without deaths occurring amongst human beings. It is there that the difficulty of giving the first information arises. That is why I think it is important to disinfect clothes.

22,951. Even if you did hear of the first case in a human subject, that might not be sufficiently early information, because the place may be already infected?—It is usually too late when we hear of the first case.

22,952. What do you think has happened in that village?—I cannot say. It is only shown that rats are dying there.

22,953. You base your opinion upon the fact that rats may have died there?—Yes.

22,954. With reference to the distribution of the villages in your district in which plague has occurred, you have already given us the numbers; have you noticed any relationship to the larger rivers? Are the villages which have been infected near the rivers?—We have one large river going across. I do not think the nearness of the village to the river has any connection with infection.

22,955. The largest number of cases has not occurred near the rivers?—We have one or two villages near the large rivers.

22,956. Of all the villages infected, do you think the larger number are villages on the banks or near the banks of rivers; or, on the other hand, do you think that the larger number of infected villages are distant from the rivers?—I should think the majority of the villages are distant.

22,957. (*Mr. Hewett.*) Do you hold the opinion that the site of a village may become infected?—I do not know whether it is the site; the infection is there, in animals, or in the floor.

22,958. The only method of getting information is to get it from the village Headman?—Yes.

22,959. Although he is living in the immediate area, he may, in reality, be just as ignorant of the first case of plague as the Collector at the headquarters of his district?—Yes.

22,960. It may be quite impossible for him to give first information?—Yes, to give information that will be in time.

22,961. Even if he ascertains the first case of plague, and the time of the year happens to be the rainy season, may it not, in some instances, take considerable time for the information to come to you by the speediest manner in which it could reach you?—I should think the Patel, in the first place, would turn the man out if he was a villager.

22,962. If the Patel went with the utmost speed, it is possible that he might have a considerable distance to go to the Mamlatdar, and it would be some days before he would hear of it?—He might be on the wrong side of the river.

22,963. Does it not happen every day during the rains that a report takes a long time to reach the Collector?—Yes.

22,964. (*The President.*) I think you were going to explain that the delay need not necessarily occur on that account, as the authorities in the village would know how to act from directions which they had previously received; do I understand that to be the case?—If the Patel thought it was a case of plague, indigenous or imported, the man would be put outside the village.

22,965. (*Mr. Cumine.*) I should like to ask you a question about the medical establishment of the district. You have at the Sadr Station a Civil Surgeon, who is purely a Government servant, have you not?—Yes.

22,966. Is there any other purely Government medical servant in the district—purely Government as opposed to Municipal or Local Board?—There is none.

22,967. In each taluka would there be more than one Municipal medical man, as a rule?—No.

22,968. His duties would be restricted to the chief town of the taluka?—Yes.

22,969. So that you may say that throughout the villages of the whole district there is no Government medical man at all?—No.

(Witness withdrew.)

Lieut. G. B. Kidd, I.S.C.

Lieut. G. B. KIDD, I.S.C., called and examined.

22,970. (*The President.*) You are Plague Officer at Belgaum?—At present.

22,971. How long have you been Plague Officer in Belgaum?—Since the 6th November of last year.

22,972. Is this the only experience you have had?—I was 11 months in Sholapur before I came here.

22,973. (*Mr. Cumine.*) Your work in this district lies amongst the villages?—Yes.

22,974. And in Sholapur did it lie amongst the villages?—In the city at first.

22,975. For how many months were you in the villages in Sholapur?—About eight.

22,976. At present how many plague-stricken villages have you to look after?—Only two.

22,977. What is approximately the largest number of villages you have had to look after in this district?—About 22.

22,978. Could you give us any idea of the length and breadth of the area they occupied?—About 150 square miles.

22,979. Were you able to pay complete attention to any one village?—I had my head-quarters at one village, and attended there personally, and visited villages within 5 miles radius of that, generally one a day.

22,980. With 22 villages you would be able to visit each village about once in three weeks?—I think once in 15 days.

22,981. What establishment have you under you at the present moment?—I have one Abkari Inspector and one Karkun.

22,982. When you evacuate a village and you have to go on to another village, whom do you leave to look after the evacuated village?—If I am supplied with a Karkun or any outside man I leave him in charge, otherwise I leave the schoolmaster or the Kulkarni or Patel, whichever I think best.

22,983. Do you generally have a special officer to spare to look after the evacuated village?—I did not; one man had four or five villages to look after.

22,984. Mr. Carmichael has told us that though the people go out without much pressure, they require constant watching to prevent their going back into the village site and getting themselves re-infected there. Is that your experience?—I dare say in the village four or five people might go back. In fact, in one village I have just given them permission to go back, but they are rather chary about it.

22,985. Are they villages which have had experience of plague before, or are they infected now for the first time?—Now for the first time.

22,986. Do you find it is easier, in the matter of evacuation, to deal with villages which contain a purely agricultural population than with villages which contain a commercial population?—It is easier with the agricultural population. I have only met with very few commercial people in the villages.

22,987. What are your views with regard to having the co-operation of the people with us in any plague measures we wish to get carried out?—Nothing can be done unless the people be got to work with the Government. Any attempt to force them to go to hospital or to segregate contacts only drives them to conceal cases, and escape to other places carrying the infection with them. The same result would follow the inoculation operations carried on, even with mild compulsion.

22,988. What are your views with regard to evacuation in the rainy season in this district? Have you any experience of it?—I went out just at the tail end of the rains. It only rained perhaps once or twice a week for a fortnight. In Sholapur taluka we turned them out in the middle of the rains. There the rains are not so excessive as they are here, I believe.

22,989. Do you think turning them out in the rains entails great hardship upon them?—It depends upon the extent of the rainfall. In Belgaum taluka, I think, it would be a great hardship, but it was not in Sholapur.

22,990. Did you find that in order to protect themselves against the rain they barricaded their huts and stopped ventilation so thoroughly as to reproduce almost the same conditions as obtained in their houses?—They tried to, of course, but I do not think they had that success in their huts which they always had in their houses.

22,991. Did you find that evacuation in the rains succeeded in stopping plague in eight or ten days?—In the only village which I evacuated during the rains plague did not stop till about 25 days.

22,992. Did you notice whether the exposure had any prejudicial effect upon the health of the young or the very old?—Not on the very young, but perhaps one or two old people died on account of the exposure.

22,993. To what extent do you think the people will protect themselves in the way of keeping out suspicious strangers? Are they on the alert to do that?—The majority of them do keep out strangers if the village is in an infected area, but, of course, some always get in.

22,994. Those are the relations of influential people, I suppose?—Yes.

22,995. When plague has got into a village in this way, do you think the people who have had previous experience of plague will evacuate a village entirely of their own accord?—They do the infected gali, but they do not the remainder of the village. They never go out of the galis in which no deaths have occurred of their own accord; at least, I have never found it so.

22,996. Have you noticed whether imported cases from Bombay seem not to infect the local people here?—No cases have come to my knowledge from Bombay.

22,997. Have you noticed what the interval is between the arrival of an imported case and some local person getting infected? Is it four or five days, or a month?—Generally three or four days.

22,998. Have you specific instances in your memory?—I am afraid I have not any special case which I could bring forward.

22,999. Have you noticed whether rats invariably die between the arrival of the imported case and the occurrence of the first local case, as though the imported case was unable to infect the local case directly, but had to do it through some medium?—I have not noticed that.

23,000. Have you any system of passes so that a man is not allowed to go from one village to another without getting a pass?—He has to get a pass from the Resident Plague Authority.

23,001. How far may he have to go to get that?—At the outside it would be 3 miles from the village, and it is probably only one, but he need not go so far as that, because the fields are divided up into sections and each section has a supervisor.

23,002. He has not to come to you to get it?—He cannot. My camp may be 15 miles away. The Resident Plague Authority would be one of the native Karkuns or an Abkari Inspector.

23,003. The standing order does not require him to come to you for a pass?—No.

23,004. You mention in your précis a case of infection being carried by grain. You say that at Mohol village many Banniahs had the plague: some Mangs stole their grain, and a few days after many Mangs got plague. Are you able to exclude the possibility of the Mangs having caught the plague themselves when they came to steal the grain?—I am afraid I have not down the date of the evacuation of the house. The house had been evacuated by the Banniahs. Of course, they might have caught it through going into an infected house.

23,005. Do not you think it is more likely that they caught it from the infected house rather than from the grain?—No, because, in the village I came to about 10 days ago, a Banniah had got the plague, and a woman who bought some grain from him got plague four days afterwards. The Banniah's daughter had died of plague, and I could not trace how this woman had got plague in any other way, as she was living in a hut at least 100 yards away from any other hut, and she had not been in the village for a month, and none of her relations had died of plague. The Banniah's daughter had died before the woman went to the house.

23,006. But might not that woman have gone to the house a few days before while the daughter was still alive?—Yes, that is possible. This Banniah was living in a hut, and he had all his stores outside the hut on a little verandah, and I do not think the woman who went to buy grain went into the hut: she would have stayed outside.

23,007. With regard to the comparative cleanliness of the people, what are the people that you think are the most liable to be attacked by plague?—There is no distinction, I think.

23,008. You mention that in two villages no Mahars were attacked, and that Maharwaras were not evacuated, although the villages were. But did not the Mahars live apart from the rest of the villagers?—In both those villages there is only a street between them. One was the high road about 50 yards, and the other was less than 10 yards.

23,009. The Mahars are considered impure by the natives, and are not allowed to enter the houses of the natives; is not that so?—Yes.

23,010. You speak in your précis of instances having come to your notice where people have stolen clothing from plague corpses and contracted the disease. Will you describe those to us?—Only two cases came clearly under my notice. The first was one in which the Mahars, who went to bury a corpse, were found with the clothing of the corpse in their hut. In the other case the man died of plague in a hut alone, and a Mahar stole his clothing.

23,011. I suppose, in order to steal the clothing, he had to go into the hut, had he not?—Yes, but only for a minute. I consider he caught the plague from the clothing.

23,012. Do you think it is dangerous for people after having evacuated a village to go and live too near it, and, if so, why?—In this cotton soil, when they are gathering their harvest, I have found two villages where the rats came out of the village and the people caught plague: in fact they moved their huts two or three times, and the rats followed them.

23,013. What makes you conclude that the rats moved?—Because I take it that the rats do not live in empty fields.

23,014. Were they house rats?—I did not actually see the rats myself.

23,015. Do you know whether they were house or field rats?—I do not know.

23,016. Have you noticed whether the villages infected this season are the same villages which were infected last season, that is, last rains?—I was not here during the last rains. I see from the Government "Gazette" that none of the villages I was working in in Sholapur have got plague this year.

23,017. Have you noticed any case where a village after having become perfectly free of plague has got attacked by plague again months afterwards, and, so far as could be traced, there has been no second infection, but apparently a recrudescence from the original germ in the village itself?—Not months afterwards.—20 days afterwards.

23,018. (*The President.*) You have always traced another importation of plague in those cases which would account for the recrudescence?—Yes; 20 days was the longest interval between the two.

23,019. Have you any system of corpse inspection in your villages?—No.

23,020. Do you think it would be offensive to the people to have the corpses of their female relations examined?—Yes, I think it would be, especially among the pardah women.

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23,021. Would it be practicable to examine the corpses of such women?—It would be impossible, I think.

23,022. Have you had any experience?—I had not even seen them alive.

23,023. You are not allowed to see them?—I presume they do not allow one to see them when dead, as one is not allowed to see them when alive.

23,024. (*Mr. Hewett.*) When you say you have not seen them alive you mean that you have not been permitted to do so on account of the customs of the people?—Yes.

(Witness withdrew.)

Lieut.-Col. C. T. Peters I.M.S.

Lieut.-Col. C. T. PETERS, I.M.S., called and examined.

23,025. (*The President.*) You are Acting Civil Surgeon in Belgaum?—Yes, and Acting Deputy Sanitary Commissioner.

23,026. How long have you been here?—Since February 1897.

23,027. Can you inform us what was done to guard against the importation of plague?—In consequence of the prevalence of plague in the City of Bombay arrangements were made so early as the 22nd January 1897 to inspect and report on the arrivals in Belgaum by rail, agreeably with Government orders, and the Municipality detailed the Medical Officer in charge of the Municipal Dispensary to do this duty, who was instructed to take any persons suffering from plague to the Civil Hospital for segregation and treatment, and the first case of plague was discovered on the 24th January 1897, a passenger from Bombay to Goa, who was detained at the Civil Hospital in the infectious ward (which is set apart for the treatment of cholera or smallpox cases in ordinary years), and was discharged cured on the 10th February 1897. The Collector of Belgaum issued orders to the Railway Police "to detain passengers at Belgaum reasonably suspected "of being infected with plague until they have been "medically examined under the orders of the Civil "Surgeon to whom such cases should be instantly "reported *direct* as they occur." By direction of the Surgeon-General a separate hut was built for the reception of plague cases by the Municipality in the Civil Hospital compound.

23,028. I want to understand how plague was introduced?—In the month of September 1897 a pensioned Naik returned from Sirur with the family of another pensioned Naik, who had died of plague in the Cantonment Bazar Sirur. According to his statement, they were segregated at Sirur from the 20th to 31st August 1897, and their clothing was boiled in the presence of the Medical Officer before they left the camp. However, on the 11th September one of the children got plague and died in the Cantonment Bazar. On the 22nd September another child sickened, and died on the 11th October, and the third on the 19th October. Shortly after, his neighbours, the Kakars, became infected in the Cantonment Bazar, where he kept a grain shop. On examining the Cantonment Death Register kept by the Cantonment Police, it appears that Jainabbee walad Silar, aged two years, died on the 7th September, the cause of death being put down under "other causes." On the 13th October 1897 another child named Gafur walad Silarbux, aged five years, died, the cause of death being put down as "fever"; and on the 21st October 1897 another child named Abdulrahman walad Silarbux died in the Native Infantry Lines Bazar, the cause of death being recorded as "fever" All these children, pensioned Naik Silarbux informed me, had glandular swellings. Thus it appears that the infected family arrived in Belgaum on the 3rd or 4th September 1897, and on the 7th September 1897 the first death had occurred.

23,029. It was an imported case which was not discovered promptly?—That is so.

23,030. And no discovery was made until a good number of cases had occurred?—That is so.

23,031. How do you account for the extension of the disease to the town of Belgaum?—In the town of Belgaum the first case of plague occurred in the family of a store lascar. The child was admitted into the Civil Hospital on the 22nd October 1897, and no doubt he had received the infection in the Cantonment. There were no further cases in the town until the 6th November 1897, when a Brahman gentleman arrived from Poona from an infected part of that city and was admitted into the Kanburgi Camp. He died there on the following morning. The first indigenous case occurred on the 23rd November 1897, when a Mahratta took ill. He was serving under a Marwari who had a shop in the Cantonment Bazar, and was found dead in the town. Shortly after his master's death, this man was infected and was removed to the Kanburgi Camp. So it appears to have come from the Cantonments. The Brahman gentleman from Poona was removed within a few hours after his arrival.

23,032. Of the several measures which you employed, which do you think are the most effective?—Evacuation, segregation, and disinfection, in the order named. In an infected locality the first thing to do would be to evacuate the place, then segregate those who had been taken out and disinfect them, their clothing, all their belongings and their houses.

23,033. Have you had much experience of evacuation?—I had nothing to do with villages. I have had only charge of camps in connection with my hospital, where hundreds of people were brought in from infected houses. Some of them were sick, and some of them were contacts, amongst whom very few cases of plague appeared afterwards.

23,034. You had nothing to do with the actual process of evacuation?—No.

23,035. How do you account for the beneficial results of evacuation?—As soon as the people are taken out into the fresh air, and removed from the infected places, the number of cases ceased altogether, or only one or two cases occurred amongst them. I remember in December 1897 a Brahman woman was confined. Her baby was 14 days old, and the question was whether she was to be removed to the health camp or not, a case having occurred in the family. Her husband went in charge of the sick child into the health camp, and the child died, but the husband remained alive. This poor woman was allowed to remain in her house, with her child and two attendants, that is to say, her sister-in-law and her husband's brother. Both the sister-in-law and the husband's brother got plague in the house. The brother died in the house and the sister-in-law died in my camp, where she was removed after her husband's death, along with this woman and her baby. A large number of people were taken away, but with the exception of the sick child, who died in hospital, there was no other case amongst them.

23,036. What are the conditions which account for the benefits of evacuation?—Principally fresh air and sunlight.

23,037. Have you had much experience of disinfection?—Yes. I have used nothing but disinfection in my hospital and the health camp.

23,038. Not in the town?—Not in the town.

23,039. In the second epidemic the measures which might have been desirable were somewhat obstructed by the heavy rains?—Yes.

23,040. What was the result?—At first the sick and contacts were segregated, but subsequently neither the cases nor the families were removed, because we had no more space after my segregation camp had become crowded.

23,041. At first you did remove them?—Yes, and then when we got overcrowded we could not remove them. The consequence was instead of only the person first attacked dying, three, four or five cases died in the

houses. I can only say that from hearsay; the people have told me that when they came to my camp. There was a large family of Pattawallas, Peons, in the different offices here. Only two of the brothers came to the camp and four other brothers perished in the house. After they were brought into my health camp, 13 in all, there was not a single case among them.

23,042. You think that because you could not sufficiently evacuate, the epidemic spread all through the town?—Yes. The way the epidemic spread through the town was this. A person got sick in one house. Perhaps the sick person and an attendant remained there, and all the rest went into a comparatively healthy locality; they carried the infection there and died there. Sometimes it was not the sick, but rats which went from one place to another.

23,043. How do you account for the benefit of evacuation if the rats move?—Evacuation alone is not efficacious, but must be accompanied with disinfection. If the people go back to their houses, they would get plague again unless the houses are thoroughly disinfected. That is why I believe disinfection measures should be strictly carried out.

23,044. Have you had any experience of disinfection?—In the case of the first village which was attacked in November, a place called Kagwad, I went over to it with the Collector That was thoroughly disinfected, because I sent over large quantities of perchloride of mercury at the request of the Hospital Assistant. To this day there has not been another case of plague in that village. I think the last case of plague was somewhere about March, but I am speaking from memory. After the first epidemic was over the people were allowed to go back to their houses, and to this day there has not been another case.

23,045. How long was the interval?—The epidemic lasted from November 1897 to March 1898. There have been no cases since.

23,046. Have you charge of the Civil Jail?—Yes. I am Medical Visitor of the sub-jail.

23,047. Had you any plague there?—We had in November 1898. I think about the 16th November an under-trial prisoner was reported to have had fever. My Hospital Assistant had gone to see him and the next day he was better, and therefore he did not go that day to see him. The fact of the matter is this. As there is no Hospital Assistant now attached to the jail, the patients are usually sent to the Civil Hospital when their cases are supposed to be serious. But this man suddenly got worse and died about 9 o'clock in the evening, on the 17th November. The next morning the Hospital Assistant, on viewing the body, found plague glands. We at first thought that as he had just returned after giving evidence at Gokak he had brought the infection from there. I went to see Mr. Carmichael and he rode up on his bicycle much quicker than myself, and found on going into one of the rooms which was formerly used as the hospital, but which is now used as a godown for grain and other things, that there was a very offensive smell in that place. Accordingly, the next day he took a disinfecting party there himself, and on digging up the place a dead rat was found. I heard subsequently that about five days or a week before this man died there were dead rats found in the godown. The grain was removed from there. The man who got plague was cooking his meals in the room next to it. My own impression is that the man got the infection, as well as the whole jail, from those rats. Afterwards rats spread all over the place, in the kitchen and offices and all the wards.

23,048. Dead rats?—Some of them were dying; they were crawling about and hardly able to move.

23,049. You say this man was under trial?—Yes.

23,050. How long had he been in jail?—I forget now; the jailer will be able to give that information.

23,051. Do you know whether it was a fortnight or a week?—Within a week.

23,052. When was he admitted into the jail? Will you kindly find out exact particulars?—Yes. (Witness subsequently noted as follows:—He was admitted into the sub-jail as an under-trial prisoner on the 25th October 1898; was sent to Gokak for trial on the 2nd November 1898; and returned thence to the jail on the 12th November 1898. He had fever on the 16th, and died in the jail at 9.30 p.m. on the 17th November 1898.)

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23,053. Do you think the rats may be infected by grain?—Yes.

23,054. Have you any observations which seem to support that view?—In the case of the pensioned Naik (Corporal) he was selling grain to sepoys and other people, who bought provisions from him. I believe the 26th Madras Infantry got it from him, because a child died in the Native Infantry Lines Bazar.

23,055. How do you know that there was no human conveyance; can you exclude that?—Of course there was human conveyance as well.

23,056. Have you any case in which you think there was clear evidence that the grain was so infected as to be able to produce plague?—No, I have no clear evidence.

23,057. Or with regard to grain bags?—No.

23,058. You have observed a difference in plague mortality at different periods of life?—Yes.

23,059. What do you say about that?—The only observations I have made chiefly are with regard to children under one year.

23,060. Is there any immunity or proneness with regard to plague at any period of life?—Children are more or less immune, either from plague attacks or fatal terminations.

23,061. Why do you say that?—In a place called Khanapur there were 38 deaths from plague and no deaths under four years of age, and only one child aged four years.

23,062. I suppose there is the normal number of children in this place?—I could not say that, but I presume that the proportion was the normal one. We always assume, under the vaccination figures, that about 32 children under one year are alive, out of the total births, viz., 40 per 1,000 of population.

23,063. You have no reason to suppose it was different here?—No. Again, in the village of Kagwad, there is no single child under one year of age who died of plague.

23,064. Were all these children vaccinated or not?—By the Vaccination Register we assume that about 32 per 1,000 of the population is available for vaccination and nearly three-quarters of them are vaccinated. I think it may have some protective influence.

23,065. Simply because the children under a certain age are not affected so much as older persons?—Yes.

23,066. With regard to rats, you place great importance upon the diffusion of plague by rats, do you not?—Yes.

23,067. Can you remember whether there were many diseased rats in the first epidemic of plague in Belgaum?—Not one was known when the epidemic first broke out; at least, I never heard of any.

23,068. Was there throughout the epidemic the same absence of dead rats, or was it most remarkable at some period in the epidemic?—Since May dead rats have been heard of, but not before; the first epidemic extended from October, 1897 to the end of April, 1898.

23,069. Therefore, throughout the first epidemic, there were, at any rate, not sufficient dead rats to attract attention?—That is so.

23,070. Nevertheless, plague was virulent?—Yes.

23,071. How does that bear upon your view of the great importance of the spread of plague by rats?—Families began to evacuate the town and went into the fields. Within a short time after they arrived there, they began to get dead rats in their huts.

23,072. Were there many cases of plague among the evacuated relatively to the number among the non-evacuated?—No.

23,073. (*Mr. Hewett.*) Do you consider that the jail was infected by means of rats?—That is my impression, because five days or a week before this prisoner died, I am told that dead or diseased rats were found.

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23,074. Did you see any diseased rats?—I did not see any myself.

23,075. What number of people went away from Belgaum?—I have no figures.

23,076. Can you form any estimate?—It varied in different periods. I think that, about January 1898, only one quarter of the population remained in Belgaum.

23,077. How many people went away from the neighbourhood altogether?—I do not think that figure can be obtained.

23,078. Had you anything to do with the inoculation here?—No.

23,079. Have you seen the records of the inoculations here?—Yes.

23,080. Where are they?—Some are kept by the Municipality and some by the Cantonment authorities.

23,081. Who has them now?—I think they will be found in the proper places.

23,082. In the case of the people who were inoculated in December 1897 and January 1898, what facts were included in the register?—The names were given in the Cantonment Register, but the professions were not given.

23,083. Have you seen the books in which the records are contained?—I have seen the Town Register once and the Cantonment Register oftener.

23,084. Have you looked to see what facts are contained in those registers?—Yes; the names, age, residence, the profession of the man, and the date of inoculation. Those are the principal things recorded in the Municipal Records. I have already stated what are contained in the Cantonment Register.

23,085. Is the residence recorded in the case of those people who were inoculated in December 1897 and January 1898?—In a general way.

23,086. What do you mean by residence in a general way?—In the town the street has been entered, and sometimes the number of the house also, so that you can find out exactly where they came from.

23,087. Is the place of residence recorded in every instance in the City Register?—I could not say that; I have not examined the books so carefully. In the cantonment some names were not put down at all, but it was simply stated that a certificate was given to a sepoy of the 26th Madras Infantry.

23,088. Can you state the number of those inoculated in the cantonment and in the Municipality?—No. I should like to state that in one case a woman left the camp with a certificate of Major Minchin that she had been inoculated, and it was found on inquiry that her name was not on the register. In other instances, I have recently found that transport mule drivers and dooly-bearers, of the Commissariat, who had been inoculated, are not recorded in the Cantonment Registers, that is to say, they had not been entered up to that date.

23,089. When were they inoculated last year?—Those papers I saw were dated September, October, and November, 1898.

23,090. And they have not been entered yet?—Probably they have by this time. I got them in the Cantonment Magistrate's office, when we were trying to fill up inoculation figures and verify the number of deaths.

23,091. How long after inoculation?—Only last month—February.

23,092. (*Mr. Cumine.*) What was the approximate number of those people who had been omitted in this way in the register at the time of inoculation? 5 or 500?—I could not say.

23,093. (*The President.*) How many do you know?—In the nominal roll of inoculated persons in the Belgaum Cantonment who have got plague, I have a number of names which have been recorded who came to the Civil Hospital after having plague, and from inquiries I found out that they had been inoculated, but the names cannot be found in the Inoculation Register.

23,094. Can you tell us how many?—46.

23,095. (*Mr. Hewett.*) How many people came into the Civil Hospital suffering from plague after having been inoculated?—11 cases from the town and 49 from the cantonment—altogether 60.

23,096. In how many of those cases were you unable to find a record of inoculation in the registers?—Only three have been identified in the Cantonment out of 49.

23,097. Forty-six people stated they had been inoculated, but you could not find out whether they had or had not been from the register?—That is so.

23,098. How many did you identify in the town?—8 were identified out of 11.

23,099. Three persons said they were inoculated, but you could not discover their names in the town register?—Yes. One came from Gadag.

23,100. The remaining two came from the town?—Yes.

23,101. Did you have any cases of inoculated persons getting plague who were not treated for plague? You have 60 down here?—These 60 names were sent to me by the Chairman of the Municipality; they have been verified cases.

23,102. You do not put them forward?—No; I only put the hospital cases forward.

23,103. (*The President.*) I believe you can give us a case in which plague occurred twice in the same person?—Yes. A boy named Miran Sahib, father's name Hussan, was admitted to hospital on the 8th November 1897. He had several glandular swellings, and his temperature, at one time, went up to 105·4. The high temperature lasted for eight days, and after that it went down, but the buboes took a long time to heal. He was discharged cured on the 28th of December 1897.

23,104. Did you ascertain how he acquired plague?—Yes. Major Minchin told me about this case. The boy was the son of Major Minchin's bhisti (water carrier). When he went to search the house, he found that the child was being secreted by the back door. It was taken up and was found with fever, and was sent to the Civil Hospital for treatment. The rest of the family were sent for segregation to the segregation camp of the Cantonment.

23,105. There had been already a case of plague in the house?—Yes.

23,106. When did you see this person again?—A note from the Hospital Assistant on plague duty in the Cantonment Bazar states that the child had been ill for seven days, as a hidden case, with fever and a bubo, on the 22nd of February 1899. It was a hidden case the second time also. He came over to the Civil Hospital on the 22nd of February 1899, with a temperature of 102·4, which went up to 102·6 on the 23rd. Then on the 24th and 25th, it gradually came down till on the 25th it became normal, and the temperature now continues normal. He has a swelling on the same groin as before; on the previous occasion he had also a swelling on the neck. This boy is still in hospital.

23,107. Was this boy inoculated?—No.

23,108. You wish to put in a statement to show that in houses containing both inoculated and non-inoculated persons some of the inoculated acquired plague, while some of the non-inoculated escaped. How many cases are there?—Four. I put those cases in, as follows:—

OCCURRENCES of PLAGUE in HOUSES INHABITED by PERSONS INOCULATED AGAINST the PLAGUE.

Full Address.	Names, Sexes, and Ages of the *inoculated* Persons who were living in the House on the Date of Attack, with the Dates of their Inoculation. Name, Sex, Age of the Attacked, if he is amongst the *inoculated*; Date of Onset of Disease, Symptoms, Issue.	Names, Sexes, and Ages of the *un-inoculated* Persons who were living in the same House on the Date of Attack. Name, Sex, Age of the Attacked, if he is amongst the *un-inoculated*; Date of Onset of Disease, Symptoms, Issue.
	HOUSE No. 1.	
Jalgar Gali, Khadakwada	Gangubai F. Vithoba. Female. Age 10 years. Not attacked. Sorabai K. Vithoba. Female. Age 30 years. Inoculated on the 8th January, 1898. Date of onset of disease, on or about the 19th January, 1898. Fever temp. 100°. Pulse 96, full and strong. Glandular swelling about the size of a large lemon behind the left ear; only one, which did not suppurate. Admitted 22nd January, 1898, discharged cured, 10th February, 1898.	Govinda F. Vithoba. Male child. Age 3 years. Not attacked.
	HOUSE No. 2.	
Cantonment, Belgaum, Madras gali.	Francis F. Rayapa.* Agnes K. Francis Rayapa.* Francis F. Francis Raya. Inoculated 8th January, 1898. Dose $\frac{1}{2}$ cc. Chowriapa Raya. 8th January, 1898. Dose 1 cc. †Mari F. Raya. 8th January, 1898. Dose 2·10 cc. Arakswamo F. Raya. 8th January, 1898, Dose 1·3 cc.	Yesu Manwell F. Francis Raya. Baby. Age 8 months.
	HOUSE No. 3.	
Konwalgali, Town of Belgaum	Tulsabai K. Narayan. Female. Age 40. Inoculated 10th January, 1898. Got ill on the 3rd February, 1898. Noticed a swelling in right groin, after being ill, accompanied with *pneumonia*. When brought to hospital on the 6th February, 1898, was rather delirious. Tongue dry and brown. Bowels said to be not moved for three days. Discharged cured, on the 3rd April, 1898.	Krishnabai kom Hantmant Female. Age 20 years. Not attacked.
	HOUSE No. 4.	
Aditwar Pet, House No. (not known).	Adiwewa K. Basteppa. Female. Age 35. Got fever 13 days after inoculation. Saw glandular swelling in left inguinal region after three days of fever. Only one—was opened on the 18th January, 1898. Discharged cured, on the 7th February, 1898.	Shivalingawa K. Timapa. Female. Age 75. Pitrawa K. Mallapa Gonje. Female. Age 35. None attacked.

* Names cannot be found in register: state that they were inoculated at the Hindalgi Camp.
† Mari was admitted on the 29th August, 1898, with a swelling in right groin. Discharged cured on the 15th September, 1898.

23,109. In the case of house No. 1, what was the age of the person who escaped?—Three years.

23,110. This is a person who was not inoculated?—Yes.

23,111. What was the age of the non-inoculated person in house No. 2?—Six or eight months old.

23,112. In the third house there were two persons?—Yes; one was a mother and the other the daughter; the mother, aged 40, was inoculated, and the daughter, aged 20, was not. The latter did not get plague.

23,113. What about the fourth house?—In the fourth house there were two persons who were not attacked; the first was 75 years old, and the other was 35 years old. Neither of them was inoculated. There was another person who was also 35 years old, who was inoculated, and got fever 13 days after inoculation, with glandular swellings. She was discharged cured.

23,114. In the first two houses and in one instance in the fourth, the persons were, I think, on account of their age, not very liable to plague?—That is so.

23,115. In the households where these cases occurred, there were other cases I think?—I cannot say that. That information is not supplied to us by the Supervisors who send them over.

(Witness withdrew.)

Mr. G. UCHGAONKAR called and examined.

Mr. G. Uchgaonkar.

(Evidence translated).

23,116. (*The President.*) You are Chairman of the Municipality of Belgaum?—Yes.

23,117. (*Mr. Hewett.*) Is there any system of registration of deaths here?—Yes.

23,118. Is there a byelaw requiring a householder to register every death that occurs in the house?—Yes.

23,119. Is that byelaw carefully observed?—Yes.

23,120. Do you think that cases of death ever fail to be registered?—All deaths have probably been duly registered.

23,121. Do you think that cases of death escaped registration at times or not?—I do not think so.

Mr. G. Uchgaonkar.

1 March 1899.

23,122. What is the population of Belgaum?—27,952 according to the census of 1891.

23,123. Is the population larger now than it was then?—The present population is 18,948.

23,124. When did the first epidemic of plague begin?—The outbreak first commenced in October 1897. In April and May 1898 the number decreased, and the epidemic finally stopped in June 1898.

23,125. When did the second epidemic begin and terminate?—It began in July 1898; it is not yet ended.

23,126. Are casual cases happening at the present time?—There was one case to-day.

23,127. Do you put in a table showing the number of cases from October 1897 to the end of 1898?—Yes.

Weeks.	1897.						1898.											
	October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.
1st -	—	—	1	1	10	6	56	53	24	22	7	8	1	1	2	2	—	—
2nd -	—	—	1	1	12	9	76	74	7	4	3	3	1	—	1	1	1	1
3rd -	—	—	2	2	32	25	56	49	12	10	1	1	3	3	—	—	5	2
4th -	1	1	7	5	40	38	37	31	7	5	4	4	1	1	—	—	2	2
Total -	1	1	11	9	94	78	225	207	50	41	15	16	6	5	3	3	8	5

Weeks.	1898.															
	July.		August.		September.		October.		November.		December.		Total 1897.		Total 1898.	
	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.
1st -	5	2	11	7	106	67	327	257	144	105	22	20	11	7	107	544
2nd -	7	6	18	16	211	149	394	299	102	68	26	21	13	10	847	642
3rd -	12	8	33	32	206	148	346	264	72	62	8	9	34	27	754	588
4th	11	8	58	44	307	223	237	157	35	32	9	8	48	44	708	515
Total -	35	24	120	99	830	587	1,304	977	353	267	65	58	106	88	3,014	2,289

23,128. Do you know the total number of cases in January of this year?—The number of cases in January 1899 is:—

Attacks.	Deaths.
14	13

23,129. What were the main measures adopted in the first epidemic?—The measures adopted to suppress the epidemic were as follows:—

(1.) The first and foremost was the segregation of the sick and of their families in hospitals and quarantine camps. This was rigorously enforced.

(2.) The second—disinfection of the infected area—was effected by removal of the roof or part of it, and by squirting a solution of carbolic acid (1 in 20), or perchloride of mercury (1 in 1,000), by means of garden syringes over the floor and all the interior walls and roof. Much light and air were let in.

(3.) All the clothes and beddings of infected persons were invariably burnt at his death or recovery, and the clothes of the rest of the family were soaked in a solution of carbolic acid or perchloride of mercury.

(4.) Families were not allowed to return to their houses until the houses had been thoroughly disinfected, and until at least 10 days had elapsed from the time any of the members of the family were exposed to some kind of infection, and until all their clothes had been disinfected in the presence of persons specially appointed for the purpose.

(5.) When a house was once vacated it was rarely allowed to be reoccupied within a fortnight or so.

(6.) Houses in the immediate neighbourhood of infected houses were treated as suspected, the inmates were segregated, and the buildings disinfected.

(7.) Houses where rats were found dead, apparently by plague, were treated as infected places, and were disinfected in the same way.

(8.) Thorough cleaning up of all the houses infected by plague and dead rats ultimately led to the wholesale disinfection of all the buildings situated within the Municipal limits.

(9.) People were induced and encouraged to erect their own sheds in fields, and to remove themselves there.

(10.) Number of huts were erected on the fort glacis for the convenience of those who were unable to have their own huts.

(11.) Until the setting in of the rains the weekly Saturday bazar was held outside the town.

(12.) Re-occupation of houses was complete by the end of June 1898.

23,130. Did you superintend the work of inoculation in the town?—I did not.

23,131. Can you say when inoculation in the town began?—On the 26th December 1897.

23,132. What privileges were given to the inoculated?—These persons appeared themselves for inoculation on the assurance given to them that no inoculated person would be liable to be removed to hospital or segregation camp against his wish. This privilege was subsequently withdrawn, and the following special rules were given to persons inoculated:—"A person "inoculated before January 16th is not liable to "segregation, even if a case of plague occur in the "house in which he is living, unless he himself gets "plague. In that case he will be sent to the Civil "Hospital, if he prefers, instead of to the Kanburgi "Hospital. Persons inoculated after January 15th "will still be liable to segregation in case plague occurs "in their houses." The result of the withdrawal of the privileges was to put almost a complete check to further progress of inoculation. The per-centage of inoculated persons over the population was 12·2.

23,133. Do you put in a statement showing the number of persons inoculated week by week?—Yes. It is as follows:—

STATEMENT showing the NUMBER of PERSONS INOCULATING, week by week at different places from 26th December 1897 to 31st December 1898, at the BELGAUM MUNICIPAL OFFICE and OTHER INOCULATION STATIONS.

Weeks.	Belgaum Town.	Belgaum Cantonment.	Shahápur.	Angole.	Vadgaon.	Khásgpur.	District.
26th Dec. 1897 to 2nd Jan. 1898	805	67	73	4	8	2	6
3rd Jan. 1898 to 9th " "	415	8	16	—	4	—	16
10th " " to 16th " "	246	20	10	—	—	—	1
17th " " to 23rd " "	120	1	15	—	1	—	5
24th " " to 30th " "	21	1	22	—	21	—	—
7th Feb. " to 13th Feb. "	43	—	18	—	18	—	—
18th July " to 23rd July "	9	—	—	—	—	—	—
25th " " to 31st " "	3	9	5	—	—	—	—
1st Aug. " to 7th Aug. "	20	14	18	—	—	—	—
8th " " to 14th " "	24	3	—	—	—	—	—
15th " " to 21st " "	72	12	17	—	4	—	10
22nd " " to 28th " "	220	15	18	—	2	—	7
29th " " to 4th Sept. "	218	33	32	2	3	—	4
5th Sept. " to 11th " "	23	49	189	—	—	—	12
12th " " to 18th " "	50	—	40	—	—	—	8
19th " " to 25th " "	52	—	28	—	7	—	—
26th " " to 2nd Oct. "	41	—	14	—	2	—	—
17th Oct. " to 23rd " "	41	28	23	32	—	—	—
24th " " to 30th " "	11	13	—	—	—	—	—
31st " " to 6th Nov. "	15	1	—	—	—	—	—
14th Nov. " to 20th " "	2	—	1	—	—	—	—
19th Dec. " to 25th Dec. "	—	23	—	—	—	—	—
26th " " to 31st " "	1	—	—	—	—	—	—
Total - -	2,565	292	448	6	65	2	69
Grand total - -	3,447						

23,134. How many cases of plague, and how many deaths occurred among the inoculated persons?—There were 62 attacks and 33 deaths.

Mr. G. Uchgaonkar.

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23,135. Do you think that the people were very much afraid during the first epidemic?—The people got frightened, partly on account of the Government measures and partly on account of the epidemic.

23,136. Did they report the number of cases accurately in the first epidemic?—They were not reported accurately.

23,137. Were the cases accurately reported in the second epidemic?—They gave information.

23,138. Why did they do that in the second epidemic?—During the second epidemic the patients, as well as the people, were allowed to remain in their houses, and therefore they quite accurately gave information and they had no fear.

23,139. Do you think that during the first epidemic many persons ran away from Belgaum suffering from plague or while they were in the incubation period of plague?—I think persons with sickness must have gone out of Belgaum.

23,140. Did they do so also in the second epidemic?—No.

23,141. Did the people here show any objection to being treated with European medicines?—Some illiterate persons have objected to European medicines, and said they would prefer native treatment.

23,142. Who prepared the statement showing the names of inoculated persons who had attacks of plague, but subsequently recovered, and also the list showing those inoculated persons who died?—I prepared this statement.

23,143. Will you put it in?—Yes.

LIST showing the NAMES of INOCULATED PERSONS who had ATTACKS of PLAGUE but subsequently RECOVERED.

Serial No.	Street.	House No.	Name in Full.	Age.	Caste.	Occupation.	Number and Date of Inoculation.		Number and Date of Attack.		Remarks.
1	Khasbag Baswan.	324	Dhondubai Govind	40	Hindu	—	447	30th Dec. 1897	280	7th Jan. 1898.	
2	Tahsildar Gali	181	Rama Balu Tahsildar	25	Mahratta	—	64	26th " "	289	8th " "	
3	Gondhali Gali	3269	Moghashim Purshotam Rodker.	—	Bráhmaa	—	979	5th Jan. 1898	345	17th " "	
4	Kangral Gali	3302	Abdul Rahman valad Hussen.	25	Musalmán	—	142	28th Dec. 1897	302	27th " "	
5	Kolkar Gali	387	Abdul Kadir	35	"	Hamál	1473	10th Jan. 1898	753	20th June 1898.	
6	Bogarwes	1447	Sorabji Edulji Burjorji	10	Pársee	—	101	28th Dec. 1897	893	20th July 1898.	
7	Mujawar Gali	295	Laxmi Monappa	30	Mahratta	—	792	4th Jan. 1898	1246	4th Sept. 1898.	
8	Math Gali	519	Bhimaji Govind Harparhali.	15	Bráhman	Student	206	28th Dec. 1897	1264	6th " "	
9	Mahadeo Gali	1381	Abaji Ganesh Kulkarni	30	"	Kárkun	26	" "	1463	16th " "	
10	Deshpande Gali.	1282	Bhaurao Ramchandra	38	"	Stamp-Vendor.	250	29th "	1618	22nd " "	
11	Gondhali Gali	3179	Deopa Laxman	26	Mahratta	—	177	28th "	1634	24th " "	
12	Burud Gali	1670	Dhodappa Sannappa	14	Burud	Burud	338	30th "	1306	28th " "	
13	Sanginkera	—	Datto Kallappa	8	Hindu	Shimpi	743	2nd Jan. 1898	1927	1st Oct. 1898.	
14	Resaldar Gali	3398	Laxman Nagesh Moghe	14	Bráhman	—	270	30th Aug. 1898	2217	11th "	
15	Aditvar Bazar	622	Sakharam Appaji	50	"	—	139	26th Dec. 1897	2227	" "	
16	Khanjar Gali	3403	Ramchandra Appaji	42	Mahratta	—	997	24th Sept. 1898	2279	12th "	
17	Samadeoti	3358	Chandrabai Govind	12	Hindu	—	1021	30th " "	2281	13th "	
18	Uppar Gali	2017	Drupatibai Monappa	7	Mahratta	—	973	4th Jan. 1898	2301	" "	
19	Kasai Gali	2559	Ibrahim valad Kashim	14	Musalmán	—	29	28th Dec. 1897	2559	20th "	
20	Mujawar Gali	273	Jaya bin Shidappa	—	Mahratta	—	48	" "	2547	" "	
21	Pangul Gali	1911	Awali kom Shiwappa	30	"	—	858	3rd Jan. 1898	2667	24th "	
22	Bogarwes	1463	Parwati Shankarrao	17	Bráhman	—	698	4th Sept. 1898	2811	29th "	
23	Konwal	1246	Dongaru Nagappa	20	Mahratta	—	362	26th Dec. 1897	2921	3rd Nov. 1898.	
24	Jalgar Gali	4086	Shidappa Wamanna	9	"	—	496	30th "	2920	" "	
25	Uppar Gali	2043	Subrao Topanna Killekar	9	"	—	1899	20th Jan. 1898	2955	5th "	
26	Khanjar Gali	3410	Krishnaji Ramchandra Gaikwad.	11	"	—	1130	8th "	2963	6th "	
27	Khasbag Baswan.	318	Kalawa Irbhadrappa	10	Lingáyat	—	1197	" "	3039	11th "	
28	Bajat Gali	1639	Chandrabai Rajaram	20	Hindu	—	438	30th Aug. 1898	3322	29th Dec. 1898.	

Mr. G. Uchgaonkar.

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LIST showing NAMES of the INOCULATED PERSONS who have DIED of PLAGUE during 1897-98.

Serial No.	Street.	House No.	Name in Full.	Age.	Caste.	Occupation.	Number and Date of Inoculation.		Number and Date of Attack		Remarks.
1	Kangral Gali	3973	Ningappa Bhannanna	30	Mahratta	Farmer	78	26th Dec. 1897	101	30th Dec. 1897	"Contact."
2	"	3973	Radhabai Krishna	11	"	—	539	30th "	166	7th Jan. 1898	"
3	Pangul Gali	1911	Shattu Shiwappa Undre	7	"	—	859	3rd Jan. 1898	192	9th "	"
4	Bogarwes	1497	Annaji Ganesh	12	"	Student	698	4th "	204	11th "	"
5	Sherkhan Gali	3534	Gawsu Khaderscheb	22	Musalmán	—	1063	5th "	214	12th "	"
6	"	3534	Khader valad Madarsaheb	63	"	Clerk	1175	8th "	217	" "	"
7	Jalgar Gali	4060	Somáji Wittoba	12	Mahratta	—	1265	" "	220	13th "	"
8	Tangadi Gali	51	Topáka Bhairu	80	"	—	1064	12th "	251	18th "	"
9	Kakatiwes	3708	Ibrahim Kassimsaheb	15	Musalmán	—	20	28th Dec. 1897	287	28th "	
10	Bogarwes	1465	Shamlal Ramlal	6	Rájput	—	450	30th Aug. 1898	871	5th Sept. 1898	"Contact."
11	Math Gali	566	Jinnappa Sangappa	23	Jain	Farmer	553	31st "	924	8th "	"
12	Ganpat Gali	1757	Nagappa Shidraya	8	Lingáyat	—	530	30th Dec. 1897	1065	15th "	
13	Anantsein Gali	921	Ambabai Annabhát	20	Bráhman	—	749	3rd. Sept. 1898	1102	16th "	
14	Gheewada	4158	Gawasu valad Hassan-saheb.	5	Musalmán	—	668	1st Jan. 1898	1313	25th "	
15	Khadu Bazár	2959	Krishna Raghunath	20	Jingar	Bookbinder	1550	11th "	1329	" "	
16	Gondhali Gali	3196	Dada Ananda	45	Narwekar	Trader	507	30th Dec. 1897	1338	26th "	
17	Khasbag Baswan.	832	Basuppa Kallappa	15	Lingáyat	—	1312	8th Jan. 1898	1648	3rd Oct. 1898.	
18	Gondhali Gali	3279	Khachu Umanna	60	Mahratta	Farmer	43	28th Dec. 1897	1636	4th "	
19	Bhandur Gali	77	Ishwar Ningappa Chougla	21	"	"	1751	17th Jan. 1898	1737	5th "	
20	Chándu Gali	4002	Kassim Mahidinsaheb	6	Musalmán	—	727	2nd "	1743	" "	
21	Ramling Khind	1164	Payappa Deoppa	20	Jain	Farmer	505	28th Aug. 1898	1696	" "	
22	Baswan Gali	1039	Shesho Janardhan Konur	35	Bráhman	Schoolmaster	991	23rd Sept. 1898	1765	6th "	
23	" "	1086	Padmanna Chandappa	50	Jain	Balgar	1078	6th Jan. 1898	1702	7th "	
24	Bhoi Gali	1964	Channappa Womappa	55	Bhoi	Fishmonger	1493	10th "	1862	9th "	
25	Ganpat Gali	1798	Chhaya Rama	10	Burud	—	433	30th Aug. 1898	1937	11th "	
26	Khada Bazár	2958	Yamnabai Appuna	7	Lingáyat	—	1447	9th Jan. 1898	1917	" "	
27	Aditvár Bazár	677	Parwati Balappa	40	Mahratta	Tailor	1013	5th "	2141	15th "	
28	Gheewada	4178	Mahamad Khatal	9	Musalmán	—	430	30th Dec. 1897	2304	20th "	
29	Khasbag Bazár	28	Gangawa kom Basuppa	45	Lingáyat	Weaver	1209	8th Jan. 1898	2648	2nd Nov. 1898.	
30	Kelkarbag	1557	Tulsa Tambdappa	50	Mahratta	—	1073	6th "	2760	11th "	
31	Jalgar Gali	4085	Ningappa Laxman	30	"	—	1567	11th "	2860	21st "	
32	Khasbag Bazár	42	Nagappa Dada	6	"	Tailor	1224	8th "	2955	4th Dec. 1898.	
33	Jalgar Gali	4124	Laxman Bharmanna	45	"	—	1592	11th "	2857	21st "	

23,144. Did you prepare the statement* which shows the social position and name of the inoculated people?—I did not. My head clerk prepared it, not by my orders, but at the direction of Dr. Boyce.

23,145. What is the meaning of this statement which is appended to the précis of your evidence headed, "Statement* showing instances where the whole "families and the majority of members of families "have died of plague within the limits of the Belgaum "Municipality?"—In that statement I show the largest number of persons dying in a family.

23,146. In some instances three out of 14 died; that does not show that the majority of the family died of plague?—That is so.

23,147. Had you anything to do with the preparation of the report* on inoculation which has been separately sent to the Commission; do you know who prepared it?—I had nothing whatever to do with that report; it was drafted by my head clerk.

23,148. When was the census taken that gave the population as 37,800?—During the months of October and November 1897.

23,149. Was it a census of the people resident in the town, or also of the people living in huts outside the town?—Only of persons living in the town.

23,150. How many, do you think, are residents in huts outside the town?—No complete census has been taken of the people living in the huts. Some of them lived in huts outside the Municipal limits.

23,151. Can you estimate the number of townspeople who are at the present moment living in huts outside the town?—Nearly 10,000.

23,152. (*Mr. Cumine.*) I do not understand how you reconcile these inoculation figures in paragraph 14 of your précis (which is as follows:—"14. The work of "inoculation in the native town of Belgaum com-"menced on the 26th of December 1897, and in "1 month and 19 days 2,094 persons were inoculated, "and from 23rd July 1898 to 17th November 1898 "the number of persons inoculated was 1,344; thus "the number of persons inoculated was 3,438,") with those in the table which you have put in?—I cannot give any explanation about the inoculation figures.

23,153. Which may I take as correct?—The figures in the table are correct.

23,154. (*The President.*) What is the intention of the table in your précis from page 10 to page 29, headed "Statement* showing instances where the whole "families and majority of members of families have "died of the plague?"—My intention was to show how many cases occurred in each house, and how many of those cases occurred in one day, and how many in each house which was disinfected.

23,155. What conclusions do you draw from this table?—I think there is no benefit whatever from disinfection.

23,156. In some houses there were many more deaths than in other houses; can you explain the difference?—I cannot explain that.

* Not printed with the Proceedings of the Commission.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Collector's Office, Belgaum.

FIFTY-NINTH DAY.

Thursday, 2nd March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Major A. V. ANDERSON, I.M.S., called and examined.

Major A. V. Anderson, I.M.S.

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23,157. (*The President.*) You are in the Indian Medical Service?—Yes.

23,158. What are your medical qualifications?—M.B.C.M., Aberdeen.

23,159. You have had a good deal of experience of the plague in the Dharwar district?—In Dharwar district for the last three months.

23,160. In which taluka?—In the Navalgund taluka, and the Nargund-petta.

23,161. How many villages are contained in that area?—53 belonging to the British Government.

23,162. And those which are not British?—They belong to the Native State. I have no charge of Native State villages.

23,163. You carried out evacuation more or less completely?—Yes, the following is a general statement of the plague work carried out:—

I began plague operations in Dharwar district on 5th December 1898, and was placed in charge of Navalgund taluka, west of the Benni Halla and Nargund Pettas, an area of about 30 miles by 10, which comprised 53 villages with a total population of between 50,000 and 60,000. To work this district in which were, from first to last, 23 plague infected villages, I had a subordinate staff of one plague karkun, two Circle Inspectors, two vaccinators, and one office clerk. In order to ascertain how many villages were actually infected, I placed one Circle Inspector in charge of the uninfected villages of Navalgund, and the two vaccinators in charge of the uninfected villages of Nargund. The number of villages in charge of each being from 8 to 10, with orders to fill in a special report form with regard to each village. These men visited one, two, and sometimes three villages each day, and as soon as they had done all in their charge they began over again, so that I had frequent and definite information regarding the uninfected villages. The plague karkun I placed in charge of the infected villages of the Navalgund and the other Circle Inspector of those in Nargund. In addition I had four policemen on plague duty, two in Nargund and two with my camp, but I had no occasion to use them for plague work. The people at each infected village were ordered to vacate the village and go into huts within three days. A general order for evacuation had already been issued, but as will be seen from the detailed report of each village, some took a month to evacuate, and even after definite orders were issued, one village took 12 days. Later, however, evacuation was always effected with in three days. A month after complete evacuation the people were allowed to return to the village to open up the roofs of the houses.

In this district, fortunately, the houses with few exceptions are single storeyed, the roofs consisting of bamboos laid on beams and covered with earth to a depth of one foot. The roof was opened by removing the earth and lifting up the bamboos, the whole length of each room for a width of two feet. After all the roofs in the village had been thus opened, the doors were opened and the houses swept out, the doors lifted off their hinges and left open, thus securing thorough ventilation.

The number of cases for the week ending 10th December was 191; for the week ending 17th December, 145; for the week ending 24th December, 172; for the week ending 30th December, 135; for the week ending 6th January, 117; for the week ending 13th January, 119; for the week ending 20th January, 60; for the week ending 27th January, 59; for the week ending 3rd February, 33; for the week ending 10th February, 31; for the week ending 17th February, 28; for the week ending 24th February (report not made up when I left the district on 28th February 1899).

The total number of villages was 26, with a population numbering 34,669.

The first village reoccupied was Talimorab, population 633, which reported plague on 27th November 1898; was totally vacated on 12th December; last case occurred 20th January; began to be opened up 9th January; re-admitted 2nd February.

The next village reoccupied was Javur, population 858. Plague first reported 26th November; totally vacated on 7th December; last case reported on 2nd January; began to be opened up 14th January; re-occupied on 14th February 1899.

Hanasi was next reoccupied, population 1,097. Plague first reported 27th October; vacated 29th November; last case occurred 17th December; began to be opened up 17th December; reoccupied 16th February 1899.

These plague measures have so far entailed no public expenditure, all work being done by the villagers themselves.

23,164. Can you divide the villages into any groups?—In my précis of evidence I divide them into three groups.

23,165. What groups?—These villages might be divided into three classes,—

1. Those infected, while evacuation was not in practice, and concealment of the outbreak was kept up as long as possible.
2. Those infected at the beginning of December, when evacuation was carried out against the wish of the people and when concealment was still practised.
3. Those infected when evacuation was in full operation, and was not opposed by the villagers, and when systematic means were adopted for ascertaining the outbreak of plague on its first appearance in each village.

In the 1st class, I would include Morab, Hanasi, Javur, Yamanur.

In the 2nd class, Shirur, Talimorab, Amargol, and Nargund.

In the 3rd class, the remaining thirteen villages, viz., Padesur, Arekurhatti, Kálvád, Tirlápur, Shirkol, Gumgol, Karlvad, Hal, Rasugal, Jagapur, Kalkeri, Kurlgeri, and Banhatti.

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23,166. You give examples of the results in the villages which you have grouped in each of these classes, do you not?—Yes.

23,167. Will you classify these results in tabular form? — The following table gives the required information:—

No.	Name of Village.	Population.	Date of First Case.	Date of Commencement of Evacuation.	Date of Completion of Evacuation.	Date of last Case.	Number of Cases between Dates entered in 4 and 6.	Number of Cases between Dates entered in 6 & 7 for each Period of 10 Days after Evacuation was completed.		Remarks.
1.	2.	3.	4.	5.	6	7.	8.	9.		10.
1	Hanasi	1,007	27.10.98	22.11.98	29.11.98	18.12.98	224	A. 15	B. 1	A.—Cases occurring within 10 days after evacuation. B.—Number of cases occurring after 10 days in camp.
2	Yamanur	984	27.10.98	13.11.98	20.12.98	12.1.99	159	A. 8	B. 11	
3	Morab	4,146	30.10.98	27.11.98	18.12.98	1.2.99	607	A. 22	B. 23	
4	Javur	852	6.11.98	27.11.98	7.12.98	3.1.99	88	A. 17	B. 10	
5	Nargund	9,597	5.11.98	25.11.98	25.12.98	23.2.99	157	A. 53	B. 71	
6	Talimorab	633	27.11.98	10.12.98	12.12.98	20.1.99	66	A. 22	B. 10	From 20th September to 12th December 108 deaths occurred in this village. Plague not reported.
7	Shirur	1,307	12.12.98	27.11.98	12.12.98	4.2.99	0	A. 25	B. 38	
8	Amargol	1,891	19.12.98	20.12.98	25.12.98	4.2.99	60	A. 45	B. 54	
9	Padesur	1,161	26.11.98	1.12.98	14.12.98	16.2.99	9	A. 3	B. 21	Rats died, 1.12.98.
10	Kalkeri	317	13.12.98	20.12.98	23.12.98	23.2.99	3	A. 1	B. 10	
11	Kurigeri	750	17.12.98	5.12.98	20.12.98	20.2.99	3	A. 5	B. 38	
12	Shirkol	3,640	21.12.98	26.12.98	29.12.98	3.2.99	29	A. 20	B. 19	
13	Arokurkatti	1,343	30.12.98	30.12.98	31.12.98	21.2.99	4	A. 7	B. 14	
14	Halkasugal	1,202	31.12.98	7.1.99	11.1.99	20.2.99	1	A. 0	B. 2	
15	Jegapur	633	31.12.98	4.1.99	8.1.99	13.2.99	11	A. 10	B. 8	
16	Hunskatti	716	31.12.98	22.1.99	24.1.99	17.2.99	0	A. 0	B. 3	31.12.98, date of imported case.
17	Karlwad	726	4.1.99	8.1.99	10.1.99	20.2.99	0	A. 0	B. 17	Rats died, 4.1.99.
18	Kalwad	1,335	4.1.99	6.1.99	9.1.99	13.2.99	2	A. 6	B. 6	
19	Gumgol	977	6.1.99	6.1.99	8.1.99	5.2.99	2	A. 3	B. 5	
20	Tirlapur	2,162	6.1.99	6.1.99	10.1.99	7.2.99	4	A. 8	B. 14	
21	Banhatti	951	17.1.98	30.12.98	7.12.98	17.2.99	0	A. 1	B. 37	Cases had occurred but were not reported before 17.1.98.
22	Madgunki	262	15.2.99	16.2.99	17.2.99	15.2.99	1	A. 0	B. 0	Imported cases occurred 15.2.99.
23	Mugaur	389	17.2.99	9.2.99	10.2.99	23.2.99	1	A. 2	B. 0	

Talimorab re-occupied 2.2.99. Javur re-occupied 14.2.99. Hanasi re-occupied 16.2.99.

23,168. Will you kindly state what opinion you have formed as to the results of evacuation?—I think evacuation has been very successful in the Dharwar district in the part of which I have been in charge.

23,169. What has been the general result of your experience?—The benefit of prompt evacuation of the infected site consists not only in lessening the severity of the outbreak in each individual village, but in lessening the tendency to spread throughout the other villages of the district, no new villages having been infected since the 6th January; while before active measures were undertaken the disease was spreading rapidly. The number of cases would undoubtedly have been fewer had it been possible to entirely prevent people from visiting the village site and surreptitiously breaking the seals and entering their houses.

23,170. The operation of evacuation had not, in all cases, a fair chance, had it?—No, it had not.

23,171. What was the nature of the difficulties which you had to encounter which probably made the results less beneficial than they otherwise might have been?—The people were very prone to return to the village to remove articles of furniture to their huts in the field, and as the staff at my disposal was limited, I could only check them by examining the seals on the houses.

23,172. Had you a sufficient staff to carry on all the operations of cleansing and disinfection and evacuation?—The cleansing had to be done by the people themselves entirely. I had no actual cleansing staff.

23,173. That also operated injuriously?—Yes.

23,174. In what way?—Because the people had to be allowed into the village to open the roofs of their houses, and while doing so they entered their houses, and were exposed to the danger of the infected site. If they had not done this work within the houses, then this cause of infection among a certain number would not have existed.

23,175. In carrying out evacuation in the most beneficial manner what conditions do you consider to be requisite?—My system in the Dharwar district has been to remove the roofs. I may as well explain that the houses there are one storey houses with bamboo roofs laid on beams. Over the bamboo they have a covering of earth to a depth of about 1 foot. I caused the earth to be removed from the roof the whole length of each room, and for a width of about 2 feet. I then lifted up the bamboos, which exposed an opening of about 2 feet by the whole length of the room, to light and air. When this had been done in every room in a village, I then opened the doors, took them off their hinges and removed them and left them open for a few days. I then allowed the people to return.

23,176. In obtaining the best results, I presume it is very necessary to get early information?—Yes.

23,177. In your treatment of plague cases, you, I suppose, draw some distinction between the requirements where there are only imported cases, as contrasted with the requirements where there are actually indigenous cases?—Yes.

23,178. Would you state what you think are the differences which are required?—In dealing with an imported case of plague, if we remove it before it has infected the locality to an uninhabited and sanitary area, and disinfect all articles likely to hold the infection, we destroy the originating cause of the plague outbreak. On the other hand the removal of an indigenous case is merely removing the sign, or symptom, of the already existing disease in the infected locality, and disinfection of the house, and its surroundings, even if done effectively and at once, does not necessarily destroy the existing disease, as, during the incubation

period of the first case, the disease has already spread we know not how far or in what direction.

23,179. And, therefore, in this latter instance, you recommend, as far as you can, complete evacuation?—Complete evacuation of the infected locality.

23,180. What was the general sanitary condition of the houses that you are now referring to?—Very bad. The people keep their cattle in the dwelling-house in all these villages in the Dharwar district.

23,181. What defects in connection with the sanitary conditions do you think operated most deleteriously in regard to plague? Was there any special defect?—I should think that this habit of keeping cattle in the house is the greatest sanitary difficulty in this district.

23,182. How does that operate with regard to plague?—Because there is always a large amount of organic matter on the floors of the houses.

23,183. How do you think that operates? Why should the large quantity of organic matter have a bad effect?—The filthy condition of the houses favours the spread of the disease.

23,184. Are the means of lighting sufficient or defective?—Very defective.

23,185. Is the ventilation and the fresh air supply to the inhabitants of the houses also very bad?—Yes, the ventilation is also very bad.

23,186. The presence of the cattle in the houses is then deleterious, in that it reduces the pure air, especially if the ventilation is very bad?—Yes.

23,187. What opinions have you formed as to the value of disinfection?—I think the disinfection of personal clothing is useful and it should always be carried out if possible; but the actual disinfection of houses, in my experience, I have found to be impracticable.

23,188. You could not carry it out?—No.

23,189. Why?—Because it would require a very large staff to work over such an extensive area as we had in the Dharwar district, and disinfection requires very skilled and constant supervision. Each individual gang of coolies must have a skilled and thoroughly reliable supervisor, who perfectly understands what we are trying to do by disinfection; and that is extremely difficult to get in this country.

23,190. Have you any cases that came under your observation in which disinfection was satisfactorily carried out?—No, not under my own observation. My opinion as to when disinfection of a house proves successful or not is when the people are taken out, and the house disinfected, and the people re-admitted at once.

23,191. You have had experience of that?—That is my idea of what disinfection ought to do. As soon as the disinfection is finished, the people should be re-admitted into the house immediately, and not kept out for 10 days or a month, because if disinfection destroys the germ, it destroys it at once.

23,192. You think that disinfection does not operate in that way at present?—No, the corrosive sublimate should destroy the germ if it is there.

23,193. You mean if disinfection is successful, that should be the result?—The people should be re-admitted and there should be no further case.

23,194. Have you any facts which show that that did occur?—Our experience in Igatpuri was against that.

23,195. I understand you mean if disinfection is a satisfactory measure it ought to operate in such a way that the people can return to their houses as soon as it is finished. It may be a few hours afterwards?—Yes.

23,196. I understand you have cases in which that did not occur?—Yes. Plague broke out in Igatpuri of the Nasik district in August 1897. At that time the theory of disinfecting the house, its inhabitants and their belongings, and allowing them to re-occupy the house at once was in favour, and as the rainfall at Igatpuri is extremely heavy it was impossible to vacate the village, population 4,000. A disinfecting party under an Assistant Surgeon, who had been working at disinfection work in Bombay, was obtained at once, and thorough disinfection with corrosive sublimate solution was carried on. After some time, as no good results appeared, I tested the solution used by the working party, and found that by the mistake of a decimal point the Assistant Surgeon in charge had been making up his solution 10 times too weak. I mention this to show that even if you have a good man in charge, such mistakes occur in working with a disinfectant. From that time the regulation 1 in 1,000 was used, but I cannot say with any better result. Igatpuri is a railway town, and the railway authorities having provided a large number of empty waggons all railway employés were moved into these with most satisfactory results. I may instance the case of two chawls, one inhabited by railway police and one by railway labourers; each of these had been disinfected four or five times and still cases occurred, when the inhabitants were moved into waggons, and no other case occurred amongst them.

23,197. With regard to the towns or villages which you evacuated what has been the population?—In the Dharwar district it varied from over 9,000 in Nargund to a small village of 300.

23,198. What was the largest town in your experience?—Ahmednagar or Sholapur, which are both of the same size, with a population of 60,000.

23,199. Which was the largest town in which you found complete evacuation could be effected?—I should think up to about 60,000 or 70,000.

23,200. Have you experience of other large towns?—I have no experience of anything over. I have been to Ahmednagar and Sholapur.

23,201. Was complete evacuation carried out in these two towns promptly or gradually?—Gradually, particularly in Sholapur. The disease obtained a strong hold of Sholapur before evacuation was carried out. In Ahmednagar on the other hand, the town was more quickly evacuated.

23,202. Does gradual evacuation act just as well as prompt evacuation?—No. My idea is that the people are still exposed to contagion—that the contagion spreads through an evacuated area, but it takes time to spread, and where we have slow evacuation the results are not as definitely beneficial as where we have prompt evacuation.

23,203. In this large place which you speak of, would it have been possible to have effected prompt evacuation?—No, I think not.

23,204. In a place of such a size that rapid evacuation is impossible, is evacuation by instalments, in your opinion, the best measure you can adopt?—In my opinion it is the best measure to adopt.

23,205. Even although it is not altogether satisfactory?—Yes.

23,206. What is the result of your consideration, founded upon experience, of the means by which plague is conveyed from one place to another?—By human intercourse mainly—by clothing. I find that in towns or villages at a distance of several miles from each other, the disease was invariably introduced by intercourse, either by persons suffering from plague or persons themselves in good health coming from an infected locality. My opinion with regard to this is that they carry the infection in their kit or clothing. When an uninfected person, I mean a man who is not suffering from disease, infects a locality, it is by his clothing and not by his person.

23,207. Have you any clear instance of that kind of infection?—In many instances which I have investigated, we find a distinct history of the introduction of the disease by human intercourse. In most places, as in Kurla, Bassein, Chembur, Trombay, Malad, Chinchni, Thana, Bhiwandi, Bhayndar, &c., we have a history of persons coming sick from an infected locality, or falling sick a day or two after their arrival prior to the occurrence of local cases. In other instances we find the disease introduced by persons themselves in good health coming from an infected locality. In Agashi the first local case occurred in the person of a Shimpi woman, to whose house some friends from Bombay had come to live. None of these Bombay people were sick or were afterwards attacked. In Kelwa also the first local cases occurred in the person of two Shimpis to whose house some Shimpis from Bombay had come five days before. These Bombay people were in good health, and after staying three days returned to Bombay. In both the above instances rats died in the houses after the arrival of the people from Bombay, and before the persons living in the house were attacked. It would appear that rats are extremely susceptible to the disease, have a short incubation period, and propagate the disease

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locally. It is improbable that they intensify the poison, as in Mahim rats died in at least three different houses and no local cases occurred in the town. At Versova a striking instance of the disease being carried by an apparently healthy person occurred. The first imported case at Versova occurred on 30th January in the person of a Brahman who came sick from Bombay. The Brahman schoolmaster of Versova visited this man while he was sick, and attended his funeral on 31st January. The schoolmaster lived in the village Talati's house. On the 2nd February the Talati's nephew, who lived in this house, was attacked by plague, while the schoolmaster himself was not attacked till the 5th of February. In Marol also the first case occurred in a house to which a number of people had come from Bombay to attend a wedding. These people were in good health, and after staying some days they returned to Bombay in good health. Here also rats died in the house after the arrival of the Bombay people and before the first human occupant was attacked. Again in the village of Madhan, an isolated case occurred prior to the outbreak there, in the person of a man to whose house a man from Bombay had come to live. Four or five days after the man's arrival rats died in the house, and the people moved out into sheds. A day or two afterwards the local occupant of the house was attacked and died, while the Bombay man escaped. In Jegapur, of the Dharwar district, a man went to visit his brother's wife, who was suffering from plague at Shelawdi, nine miles distant. Two or three days after his return rats died in his house, and three days after his daughter was attacked by plague and died. Rats also died in the adjoining houses shortly after the girl fell sick, and 29 cases occurred in the village which was promptly vacated.

23,208. In addition to the conveyance by articles belonging to human beings, what other means are there?—Within inhabited areas, and in towns or villages in close proximity to one another, the disease was often spread by rats. This was well seen in the Bandra group of villages—Bandra, Pali, Chuim, Danda, Santa Cruz, and Joo, and also in the infection of old Kurla from new Kurla—where in every case the death of rats preceded attacks among the people.

23,209. You refer to a group of villages where you yourself made inquiries?—Yes, it is my own personal investigation on the spot.

23,210. How long before a case occurred had dead rats been found?—In Bandra, which is practically a suburb of Bombay, the first local case occurred on 3rd December in a house in which dead rats had been found about one week before, and the disease at once spread in this locality. On the same date another local case occurred in another part of the town in a house where no rats had died. The disease did not spread in this locality, and it is possible that the infection had been caught elsewhere. In Pali dead rats were seen on the 6th or 7th of January, and the first case occurred on 13th January. In Chuim rats died in the beginning of February, and the first case occurred on 9th of February, although it was not reported till the 12th February. In Danda in the same way dead rats were found in several houses prior to the outbreak of the disease on 11th February. The above four villages, separated from each other by a distance of about half a mile, are included in the Bandra Municipality. In Santa Cruz, two miles distant from Bandra, dead rats were found on 12th February, and on 15th February the two first cases occurred in the house in which the dead rats were found. In Joo, which is separated from Danda by a creek, dead rats were found in a house about the 10th of April. The people thereupon removed to a shed for 10 days, and then returned to the house, which had not been disinfected, and three days after their return the first occurred in this house. It would appear that the Bandra rats spread the disease in the adjacent villages, as they entirely disappeared from the town, and were only, in the beginning of June, re-appearing. Dead rats were in the same way discovered at an early stage of the local outbreak in the villages of Vela Parla, Andheri, Goregaon, and Padali, which form an almost continuous line of houses along the Bandra-Ghodbandar Road, the intervals between the various villages being at that time filled up by the sheds of Bombay refugees. The disease appears to have been carried along this line of road as it was carried in Bombay itself. In old Kurla village, which is only separated from new Kurla town by less than half a mile of open fields, no case had occurred, though the disease was very prevalent in New Kurla during January, February, and March. On the 4th of April rats died in the house nearest New Kurla, and although that and some of the adjoining houses were vacated and disinfected, the first cases occurred in the village on 8th April. Here the presumption is that rats came from New Kurla and carried the disease with them.

23,211. How far do you think rats would have to travel from an infected place before a new place became infected?—Under a mile.

23,212. How do you know there was no human intercourse between these two places which infected each other by persons or articles, other than rats, capable of conveying the plague?—The coincidence is rather remarkable in the case of these particular villages. With regard to others at a greater distance from one another, we found we could trace the personal intercourse, but in these villages we were unable to do so.

23,213. It was more likely to occur if they were closer to each other than if they were distant?—Certainly that is an objection. That is possible.

23,214. At any rate, you have a distinct opinion that rats may infect a place?—Yes, I had an instance in Dharwar.

24,215. Will you give us that?—In Hunsikatti, a village in the Nargund Petta of the Dharwar district, two dead rats were found in a house on the 20th of January, and on the 22nd of January one sick rat was seen by me. This village is within one mile of a village called Jegapur, where cases of plague existed at the time.

23,216. Rats became affected, but how about human beings?—I was unable to trace any connexion between the two villages.

23,217. You mean the rats had become infected from this village?—Yes, rats had died in Jegapur.

23,218. I do not think that anyone doubts that rats become infected with plague. There is no question about that. That is all your case shows. In regard to the etiology of the plague, referring to human beings, how do you say that rats bear on that in the communication to human beings? I do not wish you to show whether they themselves become infected or not, but how they become factors in the communication of plague to human beings. Were the infected rats the productive cause of the plague in this new village?—Rats became factors in the communication of plague to human beings by their excreta.

23,219. Have you any instances in which an outbreak of plague appeared to be clearly produced by a previous infection of rats?—In this instance I can only say that the rats died on these dates in the village, and no case of plague had occurred. No person was then affected.

23,220. After the death of rats were they affected?—Then I moved the people out of the village, and after they went out, three cases occurred in the huts.

23,221. How long after?—The people began evacuating the village on the 22nd of January and were all out on the 24th January. On the 13th of February one case of plague occurred among the people in the fields, and on the 17th February two more cases occurred, one being a member of the family first affected. On inspecting the houses of these two people in the village, I found that the seals had been tampered with, and the doors opened.

23,222. How does that prove infection of human beings by rats? That is the point?—From that I concluded that the rats infected the village site, but that the people had gone out before any of them were infected. When these two people came back and entered their houses in the infected site they got the disease, which shows that the plague was there although not amongst the people.

23,223. Assuming they had friends in a village where there was plague, and that there had been intercommunication—personal communication—between them, that itself, without rats, would have been quite sufficient, and that might have occurred, might it not?—I formed my opinion because of the rats dying originally.

23,224. It might have had nothing nothing to do with rats, because another plague patient in another village might easily have been visited, for example, by some of these people, and direct communication without rats might have occurred?—Yes, that is so.

23,225. I want cases which exclude as far as possible obvious fallacies, and show distinctly that rats were the communicating media?—I have no further evidence than that.

23,226. Did you notice any particular distribution of the affected villages in your district in regard to plague infection?—They occurred in circles as it were, round, or in the neighbourhood of, some larger villages in the first instance; they occurred in groups.

23,227. Had this occurrence in any part of your district any association with rivers?—It seemed to follow a course along the bank of the river.

23,228. The majority of the affected villages?—Yes, but it did not cross over from one side of the river to the other very readily. The river seemed to protect the villages on the opposite bank, but the disease seemed to spread along the bank of the river on the side that was infected.

23,229. Did you find many villages distant from the river affected, or were the great majority on the banks of the river?—I would not say the great majority, but about two-thirds.

23,230. Have you formed any idea as to why that should be?—No, I cannot say that I have.

23,231. Can you recollect any conditions in the manner of living on the river bank, as contrasted with the manner of living in the villages remoter from the river, or in the habitations, or in the water supply? The water supply is the same?—The people do not use the river water for drinking purposes.

23,232. What do they use it for?—For washing their clothes and their bodies. The higher class natives go to the river and bathe before taking their food.

23,233. It is not a sacred river?—No.

23,234. In washing do not the natives take the water in their mouths during the process of cleaning their teeth, and sometimes unintentionally swallow a portion of it?—Certainly they do.

23,235. Therefore they would be drinking it to that extent?—Yes.

23,236. You cannot remember any other distinguishing feature?—No, the banks are high, and there is not much difference in the sub-soil water.

23,237. Was the character of the houses worse or better?—I did not see any difference in the state of the houses.

23,238. Not with regard to overcrowding or lighting?—There was no distinction, but, as a rule, along the bank of the river villages are closer together.

23,239. That is to say, if one house happens to become infected, the possibilities of infection of others are greater?—Yes.

23,240. That would go a good way in explaining it?—Yes, certainly.

23,241. I think you have many cases in which partial evacuation has, in the first place, been carried out, and found to be unsuccessful, and then, afterwards, complete evacuation was put into effect?—Yes, I make the following remarks regarding evacuation:—Plague having appeared in Nasik Town in October, I advised the evacuation of the town, population 25,000; 10,000 people were moved out in two or three days, and the rest of the town gradually evacuated as cases occurred. The town escaped with a mortality of between 400 or 500, though plague undoubtedly existed some time before it was discovered, and evacuation was only carried out as areas became affected. In December 1897, while working at Malegaon in the Nasik district, I tried the evacuation of large areas as cases occurred in them, keeping the people out in a segregation camp for 10 days while their houses were disinfected and limewashed, and then allowing them to return while their places in the segregation camp were taken by persons from another newly infected area. It was hoped that even should the disease spread through the whole town—population 20,000—that it would not be necessary to keep more than 2,000 or 3,000 out at a time. This failed, because the people of the supposed unaffected portion began to move their sick about and conceal cases, and the whole town had to be evacuated, after which the disease quickly ceased. During January 1898, I was employed on plague work in the Native State of Palanpur where up to then partial evacuation, as cases occurred, was being carried on. I advised certain measures, namely, the taking of an immediate census of the people, and the evacuation of the whole village on the occurrence of the first indigenous case. Although, owing to concealment of cases, we seldom heard of the first actual case, still the villages were in most cases totally evacuated before the disease obtained any stronghold, and in a few months the Palanpur Political Agency was entirely free from the disease. I afterwards visited Cutch and Kathiawar to advise on plague measures. In Kathiawar, prior to my visit, there was no plague; but while I was there a large village named Kutiana became affected, a nominal roll of the people was at once taken, and they were moved out into camp and mustered daily. Several other towns and villages of Kathiawar have since been affected, but the disease has been kept in check, and I understand that Kathiawar has got rid of the disease altogether.

23,242. In these examples, what result followed the after adoption of complete evacuation?—It had the result of getting rid of the disease.

23,243. You have also some instances in which partial evacuation alone was successful?—In 1897, indigenous cases occurred in Wadhwan, a large town of Kathiawar, partial evacuation of the affected locality was carried out and the disease stopped. This result has also been seen in Ahmedabad and in Kutiana in 1897. At that time there was no indigenous plague in the districts concerned. It appears that an isolated outbreak at a great distance from any badly infected district is more easily dealt with than an outbreak in a town or village of an already affected district, although plague measures may be as quickly undertaken in one case as in the other. It would appear that the disease requires time to become acclimatised, as it were, in any new district, and the measures which succeed in such a case will not be equally successful should the disease again appear in that town or village when the adjoining districts have become affected. In the same way the further we go, even within the same district from a bad centre of infection, the more amenable to measures of suppression does the disease become. Might I add that in the Dharwar district, I came across an instance of that in the case of a village called Alur, which was affected in July 1898, at which time plague was only beginning to get a firm hold of the Dharwar district. Twelve cases occurred in this village. The people of the affected locality were moved out, and no more cases occurred. This village has become affected again in February this year, and four cases only have occurred, but in different parts all over the village; complete evacuation has been carried out.

23,244. What has been the result?—We have not had a case for ten days. It occurred in February, but we cannot yet tell what the result will be; they have been ten days free. This village is in Mr. Lushington's charge who can probably give more definite information.

23,245. You have said more than once that you think the disease is a very local one?—Intensely local.

23,246. What is the definite locality to which, as it were, the bacillus seems to confine itself?—The inhabited area.

23,247. What part of it?—The dwelling-house.

23,248. What part of the house?—I should say the floor almost entirely.

23,249. Is there any particular characteristic in the floors of these houses from which this opinion of yours has been drawn?—They are all cow-dunged.

23,250. You have, therefore, no experience of stone floors, have you?—Not in the Dharwar district.

23,251. In any other district?—I have no experience, practically, of stone floors.

23,252. You speak only from your knowledge of mud and cow-dung floors?—Yes.

23,253. I understand you to say that if a case is imported into any district or town, however populous, if you get early information, and can absolutely segregate that patient and all contacts, the disease ought not to spread?—The disease ought not to spread.

23,254. But on the other hand, if it has already spread even to a small extent, if that extent includes distant parts of the town, such treatment is probably ineffective?—Yes, ineffective.

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23,255. (*Mr. Hewett.*) How many villages are infected in the Dharwar district altogether now?—I cannot tell that.

23,256. Have you formed any opinion as to how the villages in the Dharwar district became infected?—From the towns of Dharwar and Hubli.

23,257. Do you mean that the result of the inhabitants of the towns of Dharwar and Hubli being infected, has been that the infection has been scattered all over the district?—Certainly.

23,258. A number of the people from each of those towns left the town carrying infection with them?—Yes.

23,259. And the district of Dharwar has been extremely badly infected, has it not?—Yes, very badly infected.

23,260. Have you known any other instance in which a district has been so badly infected?—There is no other instance that I know of.

23,261. You have under your charge, at present, 70 villages, have you not?—53 is the correct number, 70 includes the Native State villages.

23,262. Have you any other European officer working in these villages under you?—I had a European officer assisting me last month to whom I handed over charge.

23,263. Practically, there is one officer dealing with all this tract?—Yes.

23,264. What is the area of it?—Thirty miles by ten.

23,265. And some of these villages, I suppose, are a great distance from each other?—Yes.

23,266. Do you think that one officer can manage so many villages satisfactorily?—No, not satisfactorily.

23,267. How many badly infected villages do you think that one European officer can satisfactorily manage, provided that he is personally responsible for seeing that the people remain away from the village sites?—It depends on the distance these villages are from one another.

23,268. Exactly, but how many villages in the immediate neighbourhood of one another, can one officer properly supervise in that respect?—Not more than two large villages of over 2,000 population.

23,269. Would you be disposed to place reliance on the efficacy of Native agency in preventing villagers from coming back to an infected site?—To a limited extent.

23,270. Would you require them to be supervised by British officers?—Certainly, always.

23,271. You say in your précis of evidence that no villages had become infected after re-occupation before January the 6th. Have any of them become infected since that date?—Only one.

23,272. Do you consider that the evacuation of villages during the rains, in the Dharwar district, was accompanied by great hardship to the people?—Certainly, there is hardship during the rains in a black cotton soil.

23,273. Do you think that the evacuation and the exposure to which people are subjected during the rains, render them more liable to sickness generally?—During the rains it does.

23,274. And that if you evacuate the people during the rains, in order to escape plague, you make them more liable to other diseases?—Yes.

23,275. Do you think that the people when influenced by the exposure to which they are subjected when out of the village during the rains, are more liable to take the plague?—I do not think so.

23,276. Do you think that when people are turned out of their villages during the rains, and subjected to this exposure, that there is a strong temptation for them to go back at night and sleep in the infected site?—Certainly.

23,277. And that consequently your measures may be to a great extent defeated owing to their doing this?—They require closer supervision.

23,278. If then you had a district infected as Dharwar was during the past rains, you would require an enormous staff of European officers working in the district?—Certainly, at the end of the rains.

23,279. Do you not think that in the Dharwar district there were many cases in which villages were infected during the rains, and the infection was not discovered until a long time afterwards?—Certainly, I am quite sure of that.

23,280. So that probably you would have required during the rains a very large staff?—Yes.

23,281. Then you speak of the fact that cattle are kept in the same house as the people, do you partially mean that the cow-dung falls upon the floor and thus affords the bacillus a soil which is favourable for its growth?—I think so.

23,282. I understand you to believe in the theory of the efficacy of disinfection, if it is properly carried out?—Yes, if it is properly carried out.

23,283. And that you would be quite satisfied with a disinfectant which effectively disinfected the floor?—No, chiefly.

23,284. I understood you to think that the infection exists almost entirely in the floor?—Almost entirely in the floor.

23,285. Where else do you think the infection exists?—It may exist in the walls; it may exist in any bundle of rags which may be overlooked, not actually in the room, but in some covered place within the wall, such as a hole in the wall which cannot be reached by any disinfectant we use.

23,286. Is it your opinion that the walls as such, and the roof as such, are likely often to contain infection?—They are not likely to do so.

23,287. Even if disinfection of the villages is carried out, and it is not always thoroughly done, it does a certain amount of good, does it not?—Yes, a certain amount of good.

23,288. Do you think that one of the causes of the infection of villages situated on a river bank may be that outsiders come more to those villages?—No, I do not think they do, because they do not use the water for drinking purposes.

23,289. Have you noticed in your experience that an outbreak of plague results in the general mortality (apart from plague) falling below the normal?—I think that is due to a defect of registration. When village officers once report plague they are very apt to put down every death that occurs as plague. If death occurs within a week of a man falling sick it is put down as a plague case. All cases of fever which terminate fatally are put down as plague cases after plague has been declared.

23,290. Then you find that if plague has been declared the village authorities who are responsible for notification notify all the cases of plague, and some notify as cases of plague sickness which is not plague at all?—In most instances; of course there are certain exceptions

23,291. Where there is concealment?—Yes.

23,292. Under ordinary circumstances would it not be rather difficult for the village officer to be certain that the original case which occurred in his village was a case of plague?—Yes.

23,293. With the best of intentions he might be deceived?—Yes.

23,294. Village Headmen are fairly reliable, as a rule, in reporting cases of cholera, are they not?—They are.

23,295. Do you attribute that to the fact that they have no difficulty in recognising the disease, owing to their familiarity with it?—I do.

23,296. Do you think that they can be expected to do the same thing as regards plague at present?—No, I do not think so.

23,297. Do you think that there is any organisation which you could substitute for them over the country generally which would help you to get immediate notification of cases of plague in rural areas?—Yes, certainly.

23,298. How would you do that?—By preparing a special form of report to be filled in by inspecting officers, who will fill in the facts, and not their own opinions as to what any particular disease may be, that is the mere fact that there are so many sick persons in

the village, and so on. The following is the form of Report.

Inspection Report Form of Circle Inspector.

Population.	Mortality during the last six months.	Cause of death during the last four weeks.	Age and caste of death during the last four weeks.	Were any of these related to each other.	Did any two or more die in the same house.	Houses in which deaths occurred inspected.	Grave-yards and burning grounds inspected.
1.	2.	3.	4.	5.	6.	7.	8.

23,299. What class of men would you put on as inspecting officers?—Men of the class of Circle Inspectors, or vaccinators.

23,300. Who are the Circle Inspectors?—I understand that Circle Inspectors are subordinates of the Land Records and Agricultural Department.

23,301. And the vaccinators are subordinates of the Sanitary Department?—Yes.

23,302. You are a Deputy Sanitary Commissioner?—I am.

23,303. Do you think that the efforts to get early and proper notification of disease might be improved if you could import into the Sanitary Department some Assistant Surgeons to supervise the work of vaccinating?—Certainly.

23,304. Do you think that it would be a good thing to have a certain number of Hospital Assistants employed as vaccinators?—Certainly.

23,305. Do you think that these measures would help you to get early notification?—They would.

23,306. Do you know anything about the byelaws in Municipalities requiring a householder to report the occurrence of death? Is it the case generally that in Municipalities in the Bombay Presidency there is such a byelaw?—They are supposed to collect and keep a return of all deaths occurring within a Municipality. This is generally done by a special clerk, who usually collects his information from the village Mahars.

23,307. Is there no obligation placed by the law, or by a byelaw, upon the householder to report a case of death himself?—In most Municipalities there is such an obligation.

23,308. Is that byelaw usually carried out?—I do not think so.

23,309. What is the reason that it is not carried out?—It is so seldom enforced.

23,310. By the Municipality?—Yes.

23,311. It is your opinion that it is allowed to fall into practical disuse?—That is my opinion.

23,312. What was the form of seal with which you used to seal up a house?—A slip of paper with the Municipal seal stamped on it, and dated. Nargund being a Municipal town, we had a Municipal seal. Elsewhere we have simply a piece of paper with the name of the house and the date, signed by one of the subordinate officers. I had five native subordinates. These seals were applied to the doors, but as there were so many villages affected at the time I first began working, I had to rely on the village officers putting the seals on and dating them, and I had to rely on my subordinate seeing that this was done.

23,313. When you say putting them on, how were they fixed on?—With gum.

23,314. Would not some other method be required in the rains?—Certainly, in the rains.

23,315. Do you find that the people remove them?—They do.

23,316. Can they remove them and put them back again?—In some instances I believe they have done that, but it has only recently been detected.

23,317. In referring to your operations at Igatpuri, you said that after you had resorted to the proper solution of perchloride of mercury, you could not say that better results accrued. Can you tell us a little more definitely what actually did happen there?—I have no record of the exact date on which I discovered the mistake that was being made in Igatpuri of using a solution of perchloride of mercury 10 times too weak, but it was some time towards the end of August when the flying column had been working about a month. I append a statement of the daily returns from Igatpuri, which show that no improvement took place during September.

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For IGATPURI TOWN for 1897.

Date.	Attacks and Deaths.		Total of the Month.		Date.	Attacks and Deaths.		Total of the Month.	
	A.	D.	A.	D.		A.	D.	A.	D.
*2.8.97		1	—	—	17.9.97	13	6	—	—
3.8.97	—	3	—	—	18.9.97	11	5	—	—
4.8.97	3	2	—	—	19.9.97	8	5	—	—
5.8.97	1	—	—	—	20.9.97	6	9	—	—
6.8.97	2	1	—	—	21.9.97	11	6	—	—
7.8.97	1	3	—	—	22.9 97	8	7	—	—
10.8.97	—	1	—	—	23.9.97	6	4	—	—
11.8.97	2	1	—	—	24.9.97	7	6	—	—
12.8.97	5	1	—	—	25.9.97	9	4	—	—
14.8.97	3	2	—	—	26.9.97	2	5	—	—
15.8.97	1	1	—	—	27.9.97	6	3	—	—
16.8.97	3	1	—	—	28.9.87	3	9	—	—
17.8.97	2	1	—	—	29.9.97	1	3	—	—
18.8.97	4	4	—	—	30.9.97	6	7	292	251
19.8.97	6	1	—	—	2.10.97	8	7	—	—
20.8.97	3	5	—	—	3.10.97	4	8	—	—
21.8.97	1	2	—	—	4.10.97	8	8	—	—
22.8.97	3	1	—	—	5.10.97	8	8	—	—
23.8.97	1	2	—	—	6.10.97	6	—	—	—
24.8.97	9	2	—	—	7.10.97	4	1	—	—
25.8.97	10	3	—	—	8.10.97	4	5	—	—
26.8.97	8	10	—	—	9.10.97	2	1	—	—
27.8.97	6	5	—	—	10.10.97	4	3	—	—
28.8.97	6	3	—	—	11.10.97	4	1	—	—
29.8.97	8	7	—	—	12.10.97	4	3	—	—
30.8.97	14	13	—	—	13.10.97	4	4	—	—
31.8.97	15	9	123	85	14.10.97	4	4	—	—
1.9.97	16	18	—	—	15.10.97	4	5	—	—
2.9.97	13	10	—	—	16.10.97	1	1	—	—
3.9.97	21	19	—	—	17.10.97	1	1	—	—
4.9.97	10	11	—	—	18.10.97	4	1	—	—
5.9.97	14	16	—	—	20.10.97	—	4	—	—
6.9.97	14	12	—	—	21.10.97	—	1	—	—
7.9.97	8	13	—	—	23.10.97	1	1	—	—
8.9.97	20	9	—	—	25.10.97	4	2	—	—
9.9.87	2	4	—	—	26.10.97	1	—	—	—
10.9.97	6	8	—	—	29.10.97	4	—	84	6
11.9 97	12	5	—	—	2.11.97	2	—	—	—
12.9.97	12	6	—	—	3.11 97	—	1	—	—
13.9.97	13	12	—	—	4 11.97	—	1	—	—
14.9.97	9	6	—	—	6.11.97	1	—	—	—
15.9.97	6	12	—	—	26.11.97	—	1	3	3
16.9.97	14	10	—	—					

* From this date all local cases occurred.

23,318. You thought at the beginning of the epidemic that the disease was a coast disease?—Yes.

23,319. Have you anything further to say upon that now?—I think it was a coast disease, because it had great difficulty in securing a hold in any new town or village. We know that many cases escaped from

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Bombay at the beginning of the epidemic, and even after railway inspection was put on still a large number of cases got through. For example, in Nasik before indigenous plague occurred there we had 35 imported cases. Those 35 imported cases, I think, did no harm.

23,320. Do you think that bubonic cases are usually likely to cause spread of the disease?—I think so.

23,321. For what reason?—Because the germ. I understand, is in the excreta.

23,322. You think, then, that the infection is carried in the clothes of the bubonic patient?—Yes; in all probability it is in the men's clothes.

23,323. When you speak of plague as a coast disease, would that mean that you think it is a disease which requires some time before it can assimilate itself to an inland place?—Yes, certainly. One other point which struck me concerning the outbreak in the Thana district was that no indigenous case occurred in any town or village more than five miles from tidal water. The disease, when it first appeared in Bombay, was undoubtedly a coast disease, and required a high sub-soil water for its development; a town with a good water supply and no drainage suffering more than an equally dirty town with a deficient water supply.

23,324. Have you found in your subsequent experience that this theory still holds good, that the towns with a good water supply are attacked, and those with a bad water supply are not attacked?—Not so much now.

23,325. Do you think, now the disease has spread about in the interior a good deal, that it more easily attacks a fresh place than it would at the beginning?—Within a certain area. Places in the Deccan are much more easily infected now. Nasik, I understand, this year has been infected from one single imported case, whereas the previous year it took at least 40 imported cases to infect the town.

23,326. Might not that depend to a certain extent upon the character of the imported case?—That is what I mean.

23,327. Supposing you had a pneumonic case, would it not be more likely to infect the locality?—I do not mean that.

23,328. But might it not be so?—No; I think it is more dependent upon the locality where the man comes from—the locality from where the man comes with relation to the place he goes to. If they both belong to the same district there is greater danger from a single case than if that case had gone to an entirely different district, as, we will say, from the Nasik district to the Central Provinces; that case would not have been so liable to infect a town there as to infect a town in the man's own district.

23,329. And in the same way a case from Bombay would not be so likely to infect Nasik as a case from some other place in the Nasik district?—That is my opinion.

23,330. The town of Sholapur has a population of 60,000 inhabitants, has it not?—Yes.

23,331. When you speak of the complete evacuation of the town of Sholapur, what do you exactly mean?—I would rather not give evidence upon Sholapur, because my experience was limited.

23,332. I should like to have an answer to the question, because you have expressed an opinion in favour of evacuation upon a large scale; did you mean that the whole 60,000 people were kept under the eye of the authorities?—Not the whole 60,000. Many went away. At least 20,000 left the district altogether, and we did not know where they went.

23,333. But did they not go about the country carrying plague with them?—Undoubtedly they did.

23,334. Then the outbreak at Sholapur was put under, to a great extent, at the expense of other places?—Yes, because the evacuation was not carried out at once. By "at once" I mean as the different areas of the town become infected. Sholapur was infected by degrees; one area was infected, and then another, and another. It had spread over several areas before any attempt whatever was made to evacuate the town.

23,335. To effectively evacuate a town of 60,000 persons (or whatever the population may be) so as to prevent the spread of plague it would be necessary to see that the people did not get away first, would it not?—Certainly.

23,336. Do you think you will ever be able to do that in a big town?—Not altogether, but my contention is that if a part of a town with a population of, perhaps, 2,000 people becomes infected, if we clear those 2,000 people out before they are badly infected they will do very little harm, even if they go away anywhere.

23,337. Then you think that the people went out from Sholapur after they were badly infected?—Yes.

23,338. And they certainly did a great deal of harm?—Yes.

23,339. What is the population of Ahmednagar?—Forty thousand.

23,340. The plague was never bad there, was it?—No.

23,341. Were the whole of those 40,000 people moved out of the town of Ahmednagar?—I cannot say from my own personal knowledge, but I understand the whole town was vacated.

23,342. The whole town was vacated, and I presume the same result as regards the going out of the people happened as at Sholapur?—No.

23,343. The same proportion of people did not fly away?—The same proportion of people did not fly away; and the disease was not spread by Ahmednagar.

23,344. I want to know whether, in your opinion, the same number of people did go away?—I do not think so.

23,345. The tendency to run away would be greater as the disease was worse?—Yes.

23,346. Have you formed any opinion as to the necessity for close segregation in the case of people who are evacuated from the town as contacts?—I consider that contacts ought to be kept in camp by themselves, if possible.

23,347. Do you think that when you have evacuated a town you should keep all the contacts in close segregation, that is to say, prevent them from going about their ordinary business, and keep them in a camp the whole 24 hours of each day?—Yes, I think it should be done, if possible.

23,348. You would not allow them to go out of the camp during the day, and simply require them to sleep in the camp during the night?—It would be preferable certainly to keep them by themselves. I do not think the risk of allowing them to go out would be very great, but it would be more efficacious to keep them under close supervision during the entire day.

23,349. Is it your experience that, when you have people who have been subjected to infection in a camp, there is a danger of the disease spreading amongst a certain number of the inmates of the camp by contact?—Individual cases do occur. It is rather exceptional, but they do occur.

23,350. As a general rule the health of the people who come into a contact camp is good, is it not?—Yes.

23,351. (*Mr. Cumine.*) Do you not think that a sketch of the village site with the deaths marked with crosses against the houses in which they occurred would be even of more value in telling whether plague was there or not, than the mere numbers of deaths occurring in the village?—Yes, certainly.

23,352. As regards the tidal rivers in the Konkan, they are great highways, are they not?—Yes.

23,353. While railways and roads are watched (sometimes at any rate) are the tidal rivers watched in the same way?—An attempt was made, at any rate in the Thana district, to watch the native craft.

23,354. When a village is evacuated in the rains, do the people, in order to protect themselves against the weather, make their huts almost as airtight as the houses in the village site?—They do.

23,355. Are those the conditions which favour the infection of the floors, and the consequent spread of plague to other members of the family where one person is attacked?—Yes.

23,356. Have you experience of the treatment of patients in their own houses in an unevacuated town or village, the leaving patients in their houses, putting them upon beds, and disinfecting the floors daily?—No. I have experience of their being left in their houses in Bhiwandi. That was done during the last

outbreak. The people were not compulsorily moved to hospital.

23,357. Were they put upon beds?—I think not.

23,358. Were the floors disinfected daily?—No.

23,359. What was the result of the leaving the patients in their own houses?—There was a very severe outbreak of plague. Originally the population of Bhiwandi was about 15,000, but it was certainly reduced to considerably under 10,000 by the flight of the people. There were 2,000 cases.

23,360. (*The President.*) You expressed the opinion that people who are removed in the rainy season to huts are affected by general disease to a larger extent than if they had not been removed?—That is my opinion.

23,361. Have you any experience that it ever happened?—No, I have had no experience.

23,362. You have, however, carried out evacuation during the rainy season?—Yes.

23,363. You made a remark about the effect of the water supply in two places. In one place there was a good water supply, but in the other place there was a deficient supply. I understood you to say that where there was a good water supply there was much plague, and where there was a deficient water supply there was less plague. Do you attribute the difference to the water supply?—I attribute it to the moisture of the soil, because in that town there is defective drainage.

(Witness withdrew.)

Lieutenant G. Thomas, I.S.C., called and examined.

Lieut. G. Thomas, I.S.C.

23,364. (*The President.*) I believe you are in the Indian Staff Corps?—Yes.

23,365. Where has your experience of plague chiefly been acquired?—I have been on plague duty in Dharwar district since the 27th of June. I was through the epidemic in Hubli as Chief Sanitary Plague Superintendent. After that I went into the Hubli taluka for about three weeks. Since then I have been in Ron taluka, engaged in district work in the villages. The subject upon which I wish to give evidence is the disinfection of houses in Hubli when I was Chief Sanitary Plague Superintendent.

23,366. Do you hold a special appointment now?—I am the Special Plague Authority in the Ron taluka. As I say, I wish to give evidence on the disinfection of the houses in Hubli. I insisted upon a payment for the disinfection, and the results were exceedingly good. When the disinfection was gratuitous I found that a good many people were giving bribes to the disinfecting muccadums in order to write "Disinfected" over the door, and go away. I found that this was not having good results, so about the middle of August I instituted a fee for disinfection. The people had to pay Rs. 2 for disinfection,—for a certain number of perchloride of mercury powders. In addition to that, they were advised to take more powders, according to the size of the house. Since I started that I have had most excellent results. The notes I have prepared show that there was an immunity of 94·6 per cent. after the first disinfection.

23,367. (*Mr. Cumine.*) Did the people do the disinfection themselves?—No, my parties did it, but the people had to pay for it. Having to pay for it they took a very lively interest in disinfecting the houses.

23,368. Why? I suppose the reason they objected to disinfection before was that it injured their things, or that they had to remove their property,—was not that it?—It was not, to a certain extent. It is the way with these people. If they have to pay for a thing they think there is something in it. I am sure it had a very marked result; the disinfection was much more satisfactorily carried out.

23,369. What were your grounds for thinking that the disinfection was more satisfactorily carried out?—Because we did not have to disinfect the same house so frequently.

23,370. In what month did you start your system?—In August. I have only the office copy of my lists here. I have sent in lists of some 450 houses taken in the worst galis in the town.

23,371. When did you allow the inhabitants to return to the disinfected houses?—The same day.

23,372. What privilege did you offer a man in return for his paying for the disinfection of his house?—Absolutely none.

23,373. Did you not offer him the privilege of allowing him to return to his house immediately without staying in the segregation camp?—No. Everybody had to pay Rs. 2. The Municipality was bankrupt. They could not afford to go on with disinfection thoroughly, and I suggested that the people should pay the money.

23,374. If you did not allow them to return to their houses, instead of going to the segregation camp, how do you know that the disinfection was so efficient?—From my records.

23,375. But the people were not in the houses; they were out in the segregation camp?—If they were twice-inoculated they were allowed to go back to their houses that evening.

23,376. Would you not expect such people to be protected in any case?—They are in a great many cases.

23,377. (*The President.*) These were only the plague houses?—Yes.

23,378. How many houses were there in this town?—About 10,000.

23,379. From how many do you draw your deductions?—Four hundred and fifty houses.

23,380. (*Mr. Cumine.*) You allowed, you say, the twice-inoculated to return to their houses after they had paid for the disinfection of them?—Everybody was allowed to return to his house if he was twice inoculated, whether his house was disinfected gratuitously or not.

23,381. If a man was not twice inoculated, was he allowed to return to his house if he paid for his disinfection?—Not if we could find him.

23,382. What did you do with him?—We sent him off to the segregation camp until he was twice inoculated.

23,383. If he was not allowed to go into his house but kept in the segregation camp, how did you know his house was efficiently disinfected?—That is what I have deduced from my returns. I have a house here, No. 1,909. There were 13 people in that house, and nine died before it was disinfected. When the tenth died the house was disinfected, and no more cases occurred in it.

23,384. Where were the people?—The people were in the house while these nine people died. We subsequently discovered that they had buried them surreptitiously.

23,385. After the house was disinfected upon payment where were the people sent?—We sent them off to the segregation camp; they came back, and they are alive still.

23,386. It is from the fact that they were unaffected after their return from the segregation camp that you deduce the efficacy of the method?—Yes.

23,387. (*The President.*) Did you do anything else; did you open up the house?—I burnt the floors.

23,388. Did you open up the house and take away the roof?—Yes, we opened up the roof.

23,389. If the people were in the segregation camp, how could they attend to the disinfecting of their houses?—If no member of the family was inoculated we allowed one to come down to superintend the disinfection of the house. He was then sent back to the segregation camp.

23,390. Were the houses also thoroughly cleaned?—Yes.

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23,391. And thoroughly ventilated?—It was difficult to ventilate those houses which had mud roofs.

23,392. What did you do with them?—Knocked holes in the walls. We did not get so much sunshine on the floor as we would have done had the houses been tile roofed.

23,393. Air was admitted freely?—Yes.

23,394. (*Mr. Cumine.*) Did you apply perchloride of mercury to each floor on one day only, or on a succession of days?—Only on the day on which the house was disinfected.

23,395. Then the difference between the system in force before you instituted your cash-payment system, and the system afterwards, is that the people personally took an interest in the disinfection after they had paid for it and they did not before?—Yes; and they did not allow the disinfecting parties to shirk their work in any way.

23,396. Has your system convinced the people of the efficacy of disinfection?—Absolutely.

23,397. How do you satisfy yourself that the house owner who used to pay the disinfecting gang a rupee or so before for omitting to disinfect his house does not do so still?—He may give the disinfecting muccadums money, but he certainly has his house disinfected too.

23,398. How do you know that?—I inspect it personally. I had four European Inspectors of the Poona police, who gave me the very greatest assistance in my disinfection.

23,399. Had you not them in the former days when the people used to pay for escaping disinfection?—I had not European Inspectors until within a week of my introducing the system. I used to go round from one house to another. I could not visit 80 houses in one day. I went round as many as I possibly could. I prosecuted one mucaddum for taking Rs. 4, and he got a month's imprisonment.

23,400. Have you any figures to show the efficacy of this system of disinfection of yours? I believe you have notes with reference to some of the worst galis, have you not?—I have taken seven or eight of the worst galis at Hubli, and from the date that I started this disinfection, I have kept a record, and have made a list of all the houses which are disinfected. This list I have made out according to galis, and have been able to see any houses which have been disinfected more than once, owing to deaths having occurred in the house. The result leads me to the conclusion that there is great benefit derived from disinfection, seeing that so few galis show houses which have been disinfected more than once. I might say that my system of disinfection is the kiln process, as well as a perchloride process.

23,401. What is the kiln process?—Burning the floors.

23,402. Did you dig them up?—No.

23,403. Did you lay grass or wood on them?—Cotton stalk wood.

23,404. (*The President.*) Do you also open up the house?—If necessary. If the house is a dark house, we knock a hole in the wall and order them to put in a window. To get a 3-feet window we have to make a 5-feet hole, because they plaster it up so as not to have a big window. In this list I specially mention the case of Yellapur gali.

23,405. (*Mr. Cumine.*) How many houses did you disinfect in that gali?—I have 39 on this list, and out of those only one had to be disinfected twice, after a period of 11 days. I was able to spend a day in Hubli on my way here, and I inquired in regard to this house, and they told me that the woman who died was 75 years old, and that she had been sick with a cough for some time, and that there had been no bubo when she died. They told me that she died of grief.

23,406. Was the reason of your disinfecting each of these houses the first time, that a plague case had occurred in it?—A plague death.

23,407. Did you disinfect immediately after the plague death?—As a rule it was the next day.

23,408. Will you tell us about another gali?—Here is Hirripet. There are 23 houses only, and not a single house had to be disinfected again. Then there is Kamaripet, in which there were 38 houses, and only one had been disinfected again.

23,409. Will you give us the whole list?—Yes, the list is as follows:—

	Houses once disinfected.	Houses twice disinfected.
Ganeshpet	37	3
Yellapur	39	1
Siddanapet	24	1
Mangalwarpet	14	1
Ghantikeri	12	1
Bhoosapet	21	0
Bawapur	45	2
Kawalpet	37	2
Dajibarpet	21	0
Kamaripet	38	1
Sidwarpet	27	3
Pinjarooni	18	1
Arkiekatti	18	1
Mullabada	17	1
Hirripet	23	0
Ninganapet	12	0
Badigeroni	6	0
Simpigali	5	0
Delaioni	12	1
Dhoragali	3	0
Pudharigali	6	0
Hirepet	9	0

23,410. Has this convinced you of the efficacy of perchloride of mercury as a disinfectant?—Yes, and burning; perchloride of mercury certainly for the clothes. That is what I lay great stress upon; they must disinfect the clothes.

23,411. You said, I think, that the success of your treatment had convinced the people of the efficacy of your system of disinfection?—Most certainly.

23,412. In what way have they shown that they are convinced?—As soon as I can get the whole figures compiled, I could show you a number of houses which have been disinfected of the people's own free will, independently of having had a case brought to our notice.

23,413. Do people come forward and ask you to disinfect their houses?—At one time they did when plague was very bad. I cannot say why, but they did.

23,414. Do you give any special privilege to people who pay for the disinfection of their houses over those who do not pay for it?—Yes.

23,415. What is that?—Instead of taking the whole of the tiles off their roofs, they only have strips taken off.

23,416. Do you think that that may be the reason of the people paying for the disinfection, and not a belief in the efficacy of the disinfection?—No; I only did that because the supervisors were making money out of the people, consequently I had to be severe. The supervisors went to a man, and said, "If you will give me a rupee, I will give you a gratuitous pass for disinfection." To guard against this I had to be rather severe. If the people were too poor to pay, I housed them in a camp for the time their roofs were entirely removed.

23,417. In the case of the houses of which you have given us particulars in your table, the twice-inoculated people were, you say, allowed to return to their houses immediately after disinfection?—Yes, provided they were twice inoculated. If we found anybody who was not twice inoculated, we segregated him.

23,418. When was he allowed to return?—As soon as he was twice inoculated. We did not recognise once inoculation.

23,419. Was an uninoculated person allowed to return to his house after 10 day's segregation?—He was kept 21 days in segregation.

23,420. And after that?—He was allowed to come back to his house. There were cases, of course, in which once-inoculated people were never segregated. I know a case in which a house had to be disinfected for a death, and never had to be re-disinfected, and the people were only once inoculated.

23,421. You have experience in the villages now?—Yes.

23,422. Do you use perchloride of mercury as a disinfectant in the villages?—I have not done any disinfecting there. I am going to begin now.

23,423. You do not know whether the people in the villages have been converted to a belief in the efficacy of disinfecting houses with perchloride of mercury?—I cannot speak from personal experience, but I know what has happened.

23,424. What has happened?—That people have been very glad to do it, and have come and asked for it. The people in the villages which it had not been intended to disinfect have come and asked for it to be done. They are very anxious to have it.

23,425. Has any special privilege with regard to liberty to return to their houses been given to people in villages who pay for the disinfection of their houses?—As yet there is no privilege, but it is understood when a village is disinfected that, provided no more plague occurs, the people will be allowed to return to their houses.

23,426. Do you think it is that privilege which makes the people anxious to get their houses disinfected?—No.

23,427. (*The President.*) How do you know?—When they come up they know they will not be allowed to go into their houses for some time.

23,428. But they are allowed to go in if the houses are disinfected?—I was not intending to disinfect Ron; I was going to allow the people in without disinfection, but the people had asked me to disinfect the town. It is in consequence of that that I am now going back to disinfect this town of 6,000 inhabitants.

23,429. In these houses in the galis the patients and contacts were removed for a short time only; how long were they removed from the houses?—If they were twice inoculated, there were not removed at all, but the inoculated members were sent to segregation camp.

23,430. What kind of houses were in these galis?—A good many of them were very good houses with rooms from 18 to 20 feet. In Yellapur as a rule there are good houses.

23,431. What is a good house?—A good house would have a large room in the middle, about 14 feet high, in which they keep the cattle, then on one side they would have a plinth of, say, four feet in height and eight feet broad off which again there would be two or three rooms. That would be a good quarter.

23,432. And the other galis?—Ganeshpet is a small gali; they are mostly labourers working in railway workshops. They have bad houses, very small and covered with tiles. The third bad gali was Kamaripet. These people were all potters, and they have bad houses as a rule.

23,433. Consisting of several chambers or one chamber?—About three rooms.

23,434. You speak of making holes in the walls and also of removing tiles, did you do both?—We never made holes in the walls to the exclusion of taking the tiles off the roof. The latter was always done.

23,435. And the holes in the walls were only made in those cases where it seemed to be necessary?—Yes, but it was not meant as a temporary measure, but with a view to permanently improving the house.

23,436. Supposing you have removed the tiles from the house, how could a person who was ill remain in it?—Every sick person was sent to the hospital.

23,437. How did those who had been twice inoculated continue to remain in the house when the tiles were off?—In the times of the rains they used to go into somebody else's house, or if they liked to make their own arrangements they could stop in their houses.

23,438. In these houses you therefore reproduced the conditions of a hut in the camp, that is, you increased the amount of ventilation?—Yes.

23,439. That is a disturbing element in all the deductions you draw?—To a greater extent in houses which were gratuitously disinfected.

23,440. Supposing these people had not been inoculated, and had been sent to segregation or health camp, would you anticipate that much plague would occur among them? Have you experience of cases occurring in the segregation camp?—Certainly.

23,441. Does plague occur much among people in the segregation camp?—I have heard of five cases. If the huts are properly constructed and ventilated the plague stops. You get very much the same conditions by opening up the houses.

23,442. Your disinfection consisted in the employment of perchloride of mercury, of burning the floors, and then of whitewashing?—I did not whitewash.

23,443. Did not the people whitewash?—A great many of them did, but it was not compulsory. In Hubli town I did not compel anybody to whitewash, but they generally did it. Whitewashing is to be made compulsory in the villages. My experience of disinfection is based entirely on Hubli.

23,444. Where the disinfection by chemicals was also reinforced by disinfection by free admission of sunlight and fresh air, and burning of the floor?—Yes, we did everything we possibly could.

23,445. You have had some experience of inoculation?—Yes, I have been inoculated myself.

23,446. I mean outside of yourself?—Yes.

23,447. You have seen a good deal of inoculation in the natives of the town?—Yes.

23,448. What opinion have you formed?—That it is an exceedingly good thing. I think it has a good effect on immunity.

23,449. If you only allow into the houses those people who in your opinion are immune against plague, how can you form an opinion as to what you have done in the houses by way of preventing plague?—It has been impossible to keep only those twice inoculated in the houses.

23,450. Or even those once inoculated?—If I had had one quarter to look after myself I could have done it.

23,451. Does nobody go who has not been once inoculated?—Cases have occurred in which uninoculated people have escaped the notice of the plague authorities.

23,452. But the great majority were once or twice inoculated?—Yes,

23,453. And were, in your opinion, to some extent immune already?—Yes.

23,454. (*Mr. Cumine.*) What idea, do you think, is at the bottom of the natives' desire to get their houses disinfected now? Is it merely that they have to pay for it?—There is a spirit of rivalry and competition in the matter which must also be taken into account; they like to think they have paid more for it than other people. One man says, "Oh, you paid Rs. 5 for your "disinfection; look at my chit, I paid Rs. 7.8." Another one says he paid Rs. 14, and he is talked about all over the town. A native does not believe in the value of what he gets for nothing; he thinks more highly of things for which he has to pay.

23,455. (*Mr. Hewett.*) Were you at Hubli when the original census was taken?—I was not; I came down after the epidemic began.

23,456. When did you get to Hubli?—On the 27th of June.

23,457. Were you occupied in taking the census every week?—No.

23,458. Did you get reports from the supervisors?—No. That was the Chief Plague Superintendent's work.

23,459. You know nothing about the figures?—Nothing that I could tell you. I heard them in conversation.

23,460. You were there in the middle of September?—Yes.

23,461. What do you think was the number of uninoculated persons actually resident in the town of Hubli in the middle of September?—I should say about 5,000.

23,462. You do not think it went below 5,000?—No.

23,463. While you were at Hubli the people were not allowed to leave the place, or supposed not to leave the place, except on a pass, were they?—No.

23,464. And that pass was only given to inoculated people?—Only given to twice-inoculated people, ten days after inoculation.

23,465. Whether they went by road or by rail?—Yes.

23,466. But a good many persons went who did not get passes, did they not?—I never found any.

23,467. If they did not, how did it happen that so few uninoculated persons were left in the town?—Because,

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I take it, that the majority were inoculated and went away, reducing the population.

23,468. The initial population was 55,000, and it went down to something between 37,000 and 38,000; that is a difference of 18,000 people. If only 5,000 of these were uninoculated, a certain portion of the uninoculated persons must have left Hubli?—Yes.

23,469. And they must have gone without passes, must they not?—That would be very difficult to say.

23,470. Do you think that the people leaving Hubli took the plague into the Dharwar district in the neighbourhood of Hubli?—Yes, I do think so.

23,471. Do you think they were mainly inoculated or uninoculated persons?—I do not think that the twice-inoculated people would have taken the plague with them.

23,472. Dharwar district has been very badly infected, has it not, both in the neighbourhood of the town of Hubli and the neighbourhood of the town of Dharwar?—Yes.

23,473. Plague is now spread all over the district, is it not?—Yes.

23,474. In your taluka how many villages are there which are now infected?—I have two villages which are submitting returns, and I have two others infected, but they have ceased to submit returns.

23,475. Then practically it is at present extinct in your portion of the district?—Yes, I hope so.

23,476. Have you been employed at Dharwar and Hubli during the rains?—Yes. On the 1st of November I went out into the Hubli taluka; and there was rain on the 8th of November for four days.

23,477. How many villages are there in the Hubli takula?—I could not say.

23,478. Could you tell us the maximum number of infected villages you had to deal with in the Hubli taluka?—I had about 20 infected villages myself.

23,479. And were there other officers working in it besides?—Yes, there were others besides in the south of the taluka, which Mr. Westropp, the First Assistant Collector, was looking after.

23,480. Did you find it possible to look after the 20 villages yourself quite satisfactorily?—No, I do not think I did.

23,481. What number of villages do you think you could have looked after satisfactorily so as to prevent the people who are evacuated from perpetually going back to their villages, and so on, in those days when you had difficulties to deal with?—In those days the difficulty I had to deal with was the fact that I had no staff at my disposal.

23,482. Then we will say during the rains?—During the rains I could look after a tract of about 30 square miles.

23,483. Could you look after such a district which was full of infection?—I think so; a tract of about 13 villages, with the staff that I have at my disposal now.

23,484. Thirteen badly-infected villages?—Yes.

23,485. How often do you think you ought to visit a village which is infected?—I ought not to leave it for more than three or four days.

23,486. Has your experience led you to form an opinion as to whether turning the people out during the rains caused great hardship?—Yes, certainly; I think it causes exceedingly great hardship.

23,487. Do you think that the general exposure made them liable to disease?—Yes, I think it did. I can give you one case. There is a village called Umachgi in the Hubli taluka, which had plague on the 30th of September. There were cases being returned every day as plague. Owing to the rains on the black cotton soil they asked Mr. Westropp to allow them to go in. He said, "You may go into your village, but you must "go out as soon as the rain stops." They returned two cases the next day. They have been living in that village ever since, and they have had no more cases of plague up to date. That was in an infected site.

23,488. How do you account for that?—I cannot.

23,489. You did not disinfect the houses?—No, we could not disinfect. That is only a single instance.

23,490. What I mean is this: are the people more subject to disease when they are sent out into the fields during the rains?—They complained bitterly about it. They look most wretched, and in a few cases I gave them blankets. During the rains they were put to more hardship, but now they do not mind it in the least. A great many of them told me that they liked being out.

(Witness withdrew.)

Rao Bahadur R. R. Bhardi.

RAO BAHADUR R. R. BHARDI called and examined.

23,491. (*The President.*) I believe you are District Deputy Collector at Dharwar?—Yes.

23,492. (*Mr. Cumine.*) I think your experience of plague has been amongst the villages in the Dharwar district, has it not?—Yes.

23,493. When did you take charge of your duties?—In March.

23,494. In what talukas have you had experience?—In Gadag taluka especially.

23,495. And what others?—I had charge of Navalgund and Ron taluka also for a time.

23,496. In spite of all efforts plague was imported?—Yes.

23,497. Was it brought by human agency, or by what agency?—By human agency; there is no doubt about that.

23,498. There were two distinct centres, I believe, one in the Ron taluka and one in the Gadag taluka?—Yes, but one of them, Aher in the Ron taluka did not actually become a centre of infection as infection was not carried from that village to any other village.

23,499. Where did the infection come from in each case?—It came from Hubli.

23,500. In the second centre I think plague raged for a long time without being discovered?—Yes.

23,501. The result was that a lot of people fled from the second centre?—Yes.

23,502. Did they carry infection to many villages in your district?—Yes.

23,503. They carried infection to some villages, and infection was carried from those villages to other villages?—Yes.

23,504. By the end of November what was the state of things?—By the end of November six villages in the Gadag táluka, five in the Ron táluka, 21 in the Navalgund táluka, five in the Mundargi Petta and one in the Nargund Petta were found to have been infected. Early in December the Navalgund and Ron tálukas and the Nargund Petta were placed in the charge of separate officers. I have been able to ascertain that in many of the villages infection was carried by human agency. I have not come to know as yet that rats carried infection from village to village in my charge, and I doubt whether they can carry it from village to village unless the villages are very close to each other as Jantli and Shirur in the Mundargi Petta. In some of the infected villages, however, rats were reported to have died, but I am inclined to believe that they caught infection which the human agency had brought.

23,505. How many villages in your charge are infected at this moment?—Altogether 39 villages, excluding the town of Gadag particularly, of which I have charge.

23,506. Do you find it possible to attend to so many infected villages? On an average how often can you visit each of the 39 villages?—It is not possible to attend to so many infected villages when I have to do plague duty in addition to criminal and revenue work. I find that I visited about half the number of infected villages. I visited one village more than three times, some three times, some two times, and the others only once. Many of the infected villages which I could not visit were visited by me before they were infected, and they happened to be infected when I was touring away from them in another direction. I have got the Mamlatdar, Mahalkari, the special Head Karkun, the district Abkari Inspector, and other circle officers to work under me.

23,507. According to your opinion, what is the best measure for suppressing the epidemic?—Evacuation.

23,508. Have you any instance where partial evacuation has been successful?—Yes, I have one instance.

23,509. As a rule, is it a failure if plague has "caught on" in a village?—Partial evacuation was successful in one case.

23,510. In most cases, if plague is established in a village, is partial evacuation sufficient to stop it?—No.

23,511. I suppose the chief thing to be desired is to keep the plague out of a village, is it not?—Yes.

23,512. Do you find that people will do this efficiently themselves? Are they alive to the importance of it?—I doubt whether they will do it themselves.

23,513. As regards the early detection of plague, what have you to say?—Early detection of plague is the chief thing to be aimed at. If it is detected before it has taken deep root into the village, even partial evacuation and disinfection of the infected houses are, in my opinion, sufficient to suppress it. But when it is detected after a considerable portion of the village is infected, complete evacuation is the best means of destroying the infection. But complete evacuation can be effected easily and without causing hardship to the people only when the weather is fair.

23,514. In the rainy season is great hardship caused to the people by evacuating them?—Yes, I think so.

23,515. Please give us an instance or two where complete evacuation stopped plague within a short time?—The following are instances:—

Chikhandigal.—Plague was detected on the 16th September, within four days after its appearance. The village was completely evacuated by the 19th November. Up to that date 180 cases occurred of which 93 proved fatal. Subsequent to complete evacuation only seven cases occurred within fourteen days. The number of deaths did not exceed that number.

Shirur.—Plague was detected in this village on the 22nd August, ten days after its appearance. The village was almost completely evacuated before the 31st August. But owing to heavy fall of rain on the 23rd September, people living outside the village went back to their houses. They were turned out again on the 4th October. Between the 1st and 23rd September 1898, the period during which people lived outside the village, only 39 cases occurred. Between the 23rd September and the 4th October, the period during which people lived in the infected houses, as many as 59 cases occurred. After complete evacuation only 14 cases occurred within 11 days.

I may cite Kitigeri as an instance where plague having been discovered early complete evacuation stopped the epidemic within a few days. The population of the village is 614. Plague appeared on the 1st January and was discovered on the 6th. Six cases had occurred before discovery. The village was completely evacuated on the 7th. After evacuation only seven cases occurred within six days.

23,516. Have you, on the other hand, instances where cases continued to occur for a long time even after complete evacuation?—There are instances where cases continued to occur for a long time even after complete evacuation. For instance, Timmapur, Madagnur, Jantli, Dambal, Alur, Ramenhalli. In Timmapur the village was completely evacuated on the 6th December 1898, and the date of the last case is 16th January 1899. 56 cases occurred after evacuation, of which 40 occurred within 19 days. In Madagnur the village was completely evacuated on the 22nd December 1898. The total number of cases after evacuation is 32, of which 22 cases occurred within about a fortnight.

23,517. Other things being equal is evacuation less effective in stopping plague when it takes place in the rains?—It may, or it may not, be.

23,518. Can you give us any instances where the epidemic has raged in a village with peculiar severity, and if so what, in your opinion, was largely the cause of the excessive severity?—In some of the villages in the Gadag, Navalgund, and Ron talukas the epidemic raged very severely, and I think that the severity of the epidemic was due to a great extent to the insanitary condition of the houses in which the cases occurred and to personal uncleanliness of the inmates thereof. Generally the houses of the agriculturists in villages are very filthy, ill-ventilated, and dark. The agriculturists tether their cattle inside their houses and allow cow-dung and manure to accumulate in the backyards. They never keep the place where cattle are tethered clean. Owing to want of ventilation and light, the houses stink so badly that one who is accustomed to live in purer atmosphere can hardly bear the smell. Further, the villagers generally do not keep their clothes and bodies clean. Many of them do not understand how to protect themselves against contagion. For these reasons I think people living in villages suffer more than those living in towns when epidemic breaks out, if they do not evacuate their unhealthy quarters and expose their belongings to sun and air. The villages which suffered more than the others in the Gadag taluka, of which I now hold charge for plague purposes, are the following:—

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Number.	Name of Village.	Population of 1891.
1	Hirebandigol	992
2	Lingdhal	1,469
3	Huilgol	1,866
4	Kadadi	1,443
5	Balaganur	1,933

In Hirebandigol cases which occurred and proved fatal between the 16th July and the 11th August 1898 were taken to be cholera cases. These cases numbered 118. As the examination of several of the patients by Dr. Barron on the 11th August showed that they were all suffering from plague, the village was promptly evacuated. The evacuation stopped the plague within about five weeks. Before evacuation 160 cases occurred including the 118 cases referred to above. After evacuation 108 cases occurred, of which 80 occurred within 17 days and 28 during the period of three weeks following the first 17 days. Out of 108 cases which occurred after evacuation, 84 proved fatal. People went back to their houses without permission about the 22nd November 1898, when it rained, but they were turned out again on the 1st December as ventilation operations were not complete. Openings were made in the roofs of all the houses for ventilation and some of the houses were disinfected with perchloride of mercury. The village was allowed to be re-occupied on the 10th January 1899, one month after the completion of the ventilation operations. A suspicious case of plague having recently occurred, the village was re-evacuated on the 25th January 1899.

The village of Lingdhal caught infection on the 22nd July 1898 from a woman from Hirebandigol. But the infection was not detected till 21st August. Within about 10 days after detection the village was completely evacuated. One hundred and seventeen cases occurred before complete evacuation, of which 85 proved fatal. After complete evacuation 318 cases occurred, of which 237 proved fatal. In no other village such a large number of cases occurred after evacuation. But out of 318 cases, 226 occurred between 3rd and 20th of September 1898. The fury of the disease during that period is attributable to heavy fall of rain during the early part of the period and subsequent cold and bleak weather. The majority of the people were inoculated by Dr. Foy when they were living in huts outside the village. More than 600 people were once inoculated and 400 twice inoculated. It may be noted that only 33 persons out of the once inoculated were attacked. But most of them succumbed. No cases occurred among the twice inoculated. The twice inoculated were allowed to re-occupy their houses after disinfection, but the once inoculated and the uninoculated occupied their houses without permission when it rained heavily on the 19th November 1898. Before orders were passed to turn out the uninoculated people again, whom I thought it necessary to keep in open air for some time longer, two imported cases of plague occurred on the 27th December 1898, and a third suspicious case of illness was brought to notice and the village was consequently re-evacuated under my orders on the 5th January. All the houses in the village were disinfected, and many of them were disinfected under the personal superintendence of the special Head Karkun, according to Mr. Stevens' kiln process of disinfection, slightly modified by Dr. Foy to suit the circumstances of the locality.

In the village of Huilgol, with a population of 1,866, both cholera and plague prevailed simultaneously. The first case of plague occurred on the 7th September.

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Infection was brought from Lingdhal. Between 7th and 18th September only eight cases of plague occurred. Between 19th and 22nd September there were no attacks nor deaths from plague. On the 24th September Dr. Foy examined 11 cases of sickness but was able to discover plague in only four cases. The other cases were found more or less suspicious and had all the symptoms of cholera. Complete evacuation could not be promptly effected owing to rain and inclement weather. By the 10th October 1898 a greater portion of the village was evacuated, and by the end of October it was completely evacuated. Only a small number of twice-inoculated people were allowed to stay in the village. But a large number of cases of plague occurred among the people residing in the village before complete evacuation. Up to the 10th October 170 cases occurred, and between 10th and 31st October 228 cases occurred. Altogether, 398 cases occurred before complete evacuation, out of which 350 proved fatal. After complete evacuation only 45 cases occurred within about a fortnight. About 300 persons were inoculated by Dr. Foy about the 10th September, of whom 35 only were inoculated a second time. Forty-five attacks occurred among the inoculated, of which 31 proved fatal. The records do not show how many cases and deaths occurred among the twice inoculated. But I think that they were few if not *nil*.

Kadadi has a population of 1,443. This village was infected about the 22nd October. Cholera was also prevailing in this village when plague appeared. Evacuation commenced about the 1st November, but took more than three weeks owing to rain and inclement weather and obstinacy of the people. Up to the date of complete evacuation, *i.e.*, 23rd November, 244 cases occurred, of which 154 proved fatal. After evacuation 117 cases occurred, of which 103 proved fatal. The date of the last case is 28th December 1898, but the severity of the epidemic continued till the 15th December, inasmuch as 107 cases occurred out of 117 up to that date after evacuation.

Balaganur is a village of 1,933 inhabitants, and in it also cholera was prevailing when plague appeared. The village was infected about the 8th October 1898. Evacuation commenced about the 20th October, but the progress of it was retarded by rain and sowing operations. Many of the people who had vacated their houses re-occupied them when it rained heavily, and they were turned out again. The evacuation was completed on the 18th November 1898. Up to the date of complete evacuation 243 cases occurred, out of which 176 proved fatal. After evacuation 299 cases occurred within about a month, of which 222 proved fatal. This large number of cases after evacuation was due to people remaining for a long time in the infected houses, and to some of the groups of their huts being close to the infected village site, and thirdly, to their not having kept plague patients at a sufficient distance from the healthy. The necessary improvements were made by the 10th December 1898. Up to that date about 275 cases occurred after complete evacuation. After that date only 24 cases occurred up to the 22nd December 1898. For about a month after that no cases occurred. Lately one case is reported to have occurred on the 22nd January 1899, and inquiry has been instituted as to how the person attacked caught infection.

23,519. I think you have some figures to give us with regard to inoculation?—Yes. I have got some figures from a statement prepared by the village officers. These show that 433 persons were twice inoculated in Lingdhal. Dr. Foy's statement shows 443. I do not know which total is correct. 678 persons were inoculated, of whom 433 were inoculated twice, according to the statement of the special Head Karkun.

23,520. How many of those twice inoculated were attacked?—None; but one of them is reported to have died of plague about the end of December, having caught infection in another infected village.

23,521. Out of those who were once inoculated, how many were attacked?—33.

23,522. And how many of them died of plague?—30.

23,523. When were the inoculations performed?—The inoculations commenced on August 21, and continued till October 14, 1898. The second inoculations commenced on August 30, and continued till October 14.

23,524. When was the epidemic at its highest in Lingdhal?—In September. Between the 3rd and 20th September it was very furious. I find that a good many were inoculated for the first time on the 7th, 8th, 27th, and 28th September, and for the second time on the 17th, 27th, and 28th September, and 14th October.

23,525. Was any census of all the people in the village taken at any time to find out who were in the village and who had left the village after the epidemic began?—It was taken immediately after evacuation. When we detected plague I issued orders to the Mamlatdar to have a census taken in all the larger villages and have a health organisation system introduced, that is, house-to-house inspection. In this particular village a census was taken.

23,526. When was it taken?—It was taken before the 5th September.

23,527. Has any superior officer of Government tested the census?—The special Head Karkun and Circle Inspector.

23,528. Have they tested it?—On inquiry made of the special Head Karkun lately, I learn that he did not test the census in each house, but that the census was taken by the schoolmaster, with the assistance of the village officers, and that whenever he had to segregate a patient and to see other inmates of the hut and those of the neighbouring huts, with a view to detect plague, he used to refer to the census register for their names. I learn that the Circle Inspector began to visit the village in October, but I have not been able to ascertain whether he tested the census or not. The number of people living in the village shortly after the plague was detected was 1,372.

23,529. Did not a large number of those run away afterwards before the epidemic ceased?—Not a large number, I think; some went away.

23,530. What became of the uninoculated?—As many as 339 of them died.

23,531. Can you give the number of the uninoculated?—There were 694 uninoculated.

23,532. How do you arrive at that figure?—The total population is 1,372. 678 persons were inoculated, and I deduct that.

23,533. Has any superior Government officer tested the figures returned to you by the village officers with regard to the number of inoculated people attacked with plague?—The statement shows that the village officers furnished the figures to the special Head Karkun, and he communicated the figures to me. On inquiry made of the special Head Karkun lately, I learn that he used to test from time to time the registration of deaths of inoculated persons in the village, and that the figures furnished are accurate.

23,534. Has anybody gone round to every house in the village after the epidemic was over and ascertained how many of the inoculated, and how many of the uninoculated, are alive?—The village officers have a register showing the names of persons who suffered from plague, and the names of persons who died; I believe the special Head Karkun has furnished the figures taken from that register to me, but I do not know whether the houses were visited or not. I rely upon the figures furnished to me.

23,535. (*The President.*) You have several instances of villages where the cases continued to occur a long time after evacuation?—Yes.

23,536. How do you explain that failure of complete evacuation?—Because the infection which they carried from the village through their having remained a very long time in that infected area was strong. Another reason was that the weather was cold and bleak, and, of course, they had to remain in huts which were not quite waterproof.

23,537. The huts which they occupied at night were very much closed up?—Yes, and they were also not waterproof; they were leaking.

23,538. Do you think that would produce plague?—If the people were predisposed to it, then they might get fever.

23,539. Within what period of time after the evacuation did the majority at these cases occur?—The majority occurred within 17 days. After that the disease declined.

23,540. Quickly?—Yes.

23,541. You mention in your précis two villages, Dambal and Alur, and you say the epidemic took a longer time to subside than in other villages, but you think that this fact cannot be taken to establish the efficacy of evacuation. Why do you say that?—I mean the contacts and patients were not segregated.

23,542. Those segregated were allowed to come in contact with others?—Yes, I presume that the contacts and the patients were not segregated from the healthy, and the healthy suffered.

23,543. You did not therefore carry out evacuation properly?—The villages were in the charge of the Mahalkari who was acting under my orders. My impression is that the segregation of the patients and contacts was not strictly carried out, and that people visited evacuated houses stealthily. But the fact of people having remained in the infected villages for a longer time before evacuation, and the cold and bleak weather which prevailed at the time of evacuation, seem also to have contributed to the steadiness of the disease.

23,544. With reference to your cases of inoculation was there any selection whatever of the persons inoculated, or did they volunteer?—We inoculated those who offered themselves. At the beginning, of course, many did not know the advantages of inoculation, and they were unwilling, but I was there and Dr. Foy was there, and we explained the advantages of inoculation, and we induced some of the people to get themselves inoculated. Subsequently when the inoculations were done I was not present, Dr. Foy was alone there, and I believe that the people offered themselves for inoculation knowing its advantages.

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23,545. As a rule these people who voluntarily came forward would be the more intelligent people I suppose?—I think they are all equally intelligent. They are generally illiterate people.

23,546. There is no particular prominent intelligence?—No; I do not think so.

23,547. And the houses were all the same?—Yes.

(Witness withdrew.)

Captain A. F. C. Colomb, I.S.C., called and examined.

Capt. A. F. C. Colomb, I.S.C.

23,548. (*The President.*) You are a member of the Indian Staff Corps?—Yes.

23,549. How long has your plague experience extended?—From the 13th of November 1898.

23,550. (*Mr. Hewett.*) Have you been employed in the Dharwar district ever since then?—I was in the Dharwar district the whole time.

23,551. Employed in the villages?—In village work altogether.

23,552. In what taluka?—In the Hubli taluka from the 13th November to the 13th December. I was then transferred to the charge of the Dharwar taluka.

23,553. Have you formed from your observations any opinion as to how the Hubli taluka and the Dharwar taluka respectively were infected?—It happened before my time, so I could hardly do so. Looking back to the village registers before the staff was properly organised it seemed to me that the records were not trustworthy. I tried to trace plague back, and I found that it was not worth doing.

23,554. Do you think the people from Dharwar town infected the Dharwar taluka?—I think it is undoubted in some cases. The Patel at Gadag (infected, 26-10-98) told me that many people from Dharwar came there and died of plague, but that was before my time. There were no villages infected by Dharwar since I took over the charge.

23,555. You had no work to do in Dharwar town?—No.

23,556. Have you paid attention to the possibility of infection by means of rats?—Yes, I have gone into that as closely as I could.

23,557. Have you found any instances in which rats began to die in a village without the possibility of the village having become infected by human beings, or by clothes brought by a human being?—No, not in any of the villages in my charge. In all cases there has been someone from the village, more often than not a member of the household where a mortality of rats occurred, who had been to an infected part.

23,558. Can you give specific instances of persons who had been to an infected place, and in whose houses the mortality among rats subsequently began?—I can. I take Halé Tegur as an instance. Halé Tegur is on the Belgaum district boundary, up in the north-west corner of the taluka. The village of Tegur, just about one and a half miles away, had plague. A Mahar of Halé Tegur used to go and work in the Kulkarni's house in Tegur and the Patel and the Kulkarni made no objection. A mortality among rats occurred in the Mahar's house in Halé Tegur. This village had to be evacuated.

23,559. Have you any other case?—I can give a case which is not in my précis, that of Mandihal (infected, 21-2-99). The first case of undoubted plague was that of a woman. Her husband was connected with police duties, and used to travel about somewhere near Dharwar, I could not discover where. A mortality among rats occurred in that house. The plague case was said to have been on the 10th, but the date had not been exactly recorded. A dead rat was found in the same village on the 10th, that was certain.

23,560. (*The President.*) I notice you use the term "rat-fall" in your précis; would one dead rat come under that category?—There may have been one dead rat in a house, but two or three is more general.

23,561. (*Mr. Hewett.*) When you found two or three dead rats in one house did it generally happen that other dead rats were found in the village, or not?—Almost invariably.

23,562. Does the rat mortality ever become very large?—That I cannot tell because the village is evacuated before we would be able to see it.

23,563. How long after the rats begin to die, does local infection among human beings begin to occur?—I worked it out at about three days.

23,564. From how many villages are your figures taken?—22.

23,565. What is the maximum period between the two events?—10 days according to the register, but the dates in it are not trustworthy; infection in this case occurred before my time.

23,566. What is the maximum you have seen yourself?—The maximum which I can be pretty certain about is six days. These rat mortalities are taken from reports by my native assistants who have to report them, and of course they may be wrong.

23,567. And the minimum?—The minimum is put down as one day.

23,568. May we take it that it is always possible that a rat mortality may not have been observed at first?—That is quite possible.

23,569. So that the intervals may be greater than your facts would give?—Yes.

23,570. Have you had some villages which have been infected without there being mortality among rats?—Yes, there have been cases.

23,571. Are such cases rare in your experience?—There are one or two cases noted. At Kabenur there was no mortality among rats before the plague appeared because plague was brought into the village by an imported case with plague on at the time. It was called an indigenous case in the report, because the man was a member of the village.

23,572. This would be in accordance with your idea that the origin of plague in a particular village is importation from outside by human beings?—Absolutely.

23,573. Were there any other villages where you had no mortality among rats?—Yes, Kotbagi, and Kallur.

23,574. In each of these villages was the first case of plague detected that of a person who resided in the village, but who got infected outside?—It was.

23,575. Have you noticed anything with regard to the virulence of the attack in these three villages compared with any other village in which rat mortality did precede local cases?—Decidedly; the infection was less general.

23,576. What inference would you draw from that?—That if the rats had had time, they would have made the infection more general, and the percentage of deaths would have been much higher.

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23,577. Your inference is, that having been able to put your finger on the place where the plague first occurred, your measures for stamping it out were more effective?—Yes, because infection had not been disseminated.

23,578. In addition to these three villages in which there was clearly no mortality among rats, there were a certain number of villages in which you were not able to definitely ascertain that there had been mortality among rats?—Yes, I have noted five cases.

23,579. In those villages was the mortality severe among human beings?—It was very light.

23,580. In those cases, do you think it possible that you also got hold of the first case?—I think I must have.

23,581. But you cannot say whether they were cases of local persons who got infection elsewhere?—I cannot say for certain, as I did not inquire into the origin of the disease here, but I have very little doubt that infection was from outside.

23,582. Can you say whether prompt evacuation has had a good effect upon the virulence of plague?—Yes, it has.

23,583. Can you give us figures to show that?—I have cases of eight villages which were evacuated before the first case occurred; that means that there had been a mortality among rats, and the village began to go out before the first case occurred. The average death-rate in those villages was 1·10 per cent. up to the 10th day after complete evacuation.

23,584. At your examination of those villages, were you able to satisfy yourself that there had been no plague cases before you took the people into camp?—Yes, in most cases, from the birth and death registers. There are five villages in which it commenced one day after the first case, and the average number of attacks up to the 10th day after evacuation was complete was 1·11 per cent. There were four villages in which it commenced two days after the first case had occurred, and the average attacks up to the 10th day was 1·84. I omit Kallur, because I feel sure that here the disease was cholera and not plague.

23,585. Will you specify the total population of each of the following groups:—1stly, the villages which were evacuated before there was any case; 2ndly, villages which were evacuated one day after the first case; and 3rdly, villages evacuated two days after the first case?—The total populations are as follows:—

1st. Villages commencing evacuation before the first case occurred - - -	14,868
2nd. Villages commencing evacuation one day after the first case had occurred - - - -	5,194
3rd. Villages commencing evacuation two days after the first case had occurred - - - -	3,448

23,586. Can you furnish any figures which show a higher incidence of attack among places in which evacuation was not prompt?—From my own experience I give three villages in the Hubli taluka, Unkal, Shirguppi, and Yerguppi.

Unkal.—Infected 11th September 1898:—
Evacuation commenced about 1st November 1898.
Evacuation completed 19th November 1898.
There were 487 attacks up to the completion of evacuation, and subsequently only one attack up to 11th December 1898.

Shirguppi.—Infected 14th October 1898:—
Evacuation commenced about 1st November 1898.
Evacuation completed 28th November 1898.
There were 130 attacks up to the completion of evacuation, and subsequently only 10 up to 10th December 1898.

Yerguppi.—Infected 28th September 1898:—
Evacuation commenced about 1st November 1898.
Evacuation completed 29th November 1898.
There were 456 attacks up to 29th November 1898, and three between that date and 10th December 1898.

23,587. Will you give the population of each village?—Unkal, 3,915; Shirguppi, 1,919; Yerguppi, 1,702.

23,588. Have you had any villages in which the mortality among rats occurred without subsequent deaths from plague among human beings?—Yes. Seven villages have been noted as having been immune through timely evacuation, although there had been mortality among rats. There are, in addition, some 20 villages in the taluka which were evacuated by reason of high mortality, or their being in the neighbourhood of infected areas which have, so far, escaped infection.

23,589. What does your experience enable you to say as to the advantage or disadvantage of evacuating villages?—I believe that rapid evacuation is everything, and I think that the mortality from plague would be less if, instead of waiting till the disease was present, whole districts were evacuated at once on plague appearing anywhere near them.

23,590. Is your experience in dealing with plague in this part of India entirely confined to the period of cold weather?—Yes.

23,591. Do you think that when the monsoon is on it would be practicable to evacuate a large number of villages?—Not on black cotton soil. If plague occurs again during the rains, I would camp the people on the roofs of flat-roofed houses. It is no hardship to evacuate villages during the rains in the hilly part of the Dharwar taluka. Here the people have built houses to meet such a contingency.

23,592. Do you think that taking the people out into the black cotton soil during the rains would cause them hardship?—It would cause them terrible hardships; I do not think it could be done at all.

23,593. Can you give us instances in which infection was carried through human beings?—I have already referred to Halé Tegur. Further instances are:—

Tegur.—Infected on 26th November 1898, by what was reported as an indigenous case. The first sufferers were two women who kept a sort of travellers' rest-house. They may have become infected through contact with their guests, but to make assurance doubly sure, one of them went to Gadag which was infected, and contracted plague within eight days of her return. The second woman nursed and slept in the same bed with the first. While these two were ill with plague, a woman from another house joins them and sits with them repairing baskets, and brings back with her some cakes, presumably from the infected house, of which she and her son partake; next day the son has plague.

Aminbhavi.—A long series of deaths from plague occur in the hut of the Timapur Kulkarni living in Aminbhavi. The two surviving members of the family are placed in a contact hut from which they abscond about the 26th January to Navalgund, where one of them promptly dies of plague, the disease having declared itself *en route*.

Tarkor (Tadkod).—Infected 24th January 1898, by what was reported as an indigenous case. The patient was a woman. Her brother was ill with plague at Khanapur, a neighbouring village, and she went to nurse him, remaining with him for two days before his death. She returned to Tarkor, and was attacked with plague within ten days of her return. The day after seizure her son was also attacked.

Kallapur.—Infected on 24th January 1899, by what was reported as an indigenous case. Patient was a woman, who on 17th January 1899, went to, and passed the night at, Alnavar, an infected village. There she bought some clothing which she was wearing when she was taken ill. Evidence was not procurable as to whose house in Alnavar she stopped in.

Jirigivad.—Infected 1st February 1899, by what was reported as an indigenous case. The first case was a trader who was in the habit of visiting all markets and infected and uninfected villages alike. The infection cannot be attributed to any certain village.

Kotur.—Reported as infected on the 4th February 1889 by several simultaneous indigenous cases. This village is a somewhat remarkable case of double infection almost simultaneously. Among the low castes at one end of the village, a house was pointed out as being the first house in the village to be evacuated. It appears that there had been a rat-fall there, and that the owner had locked the house and left hurriedly. His son had died at Navalur of plague about four months ago, and he had revisited Navalur within 10 days of vacating his house. Presumably, he brought back from Navalur some articles from his late son's house through which infection reached the rats. At the other end of the village, among the high castes, a woman died on the 30th January; she was a yara

maker, and travelled from village to village selling the fruits of her industry. Her death was reported as fever, but there was a rumour of a rat-fall in her house on the 27th of January. A case of undoubted plague occurred in the same house on the 5th February.

These few cases may, of course, have been mere coincidences, but as inquiries into each fresh outbreak result invariably in the discovery of facts which point to human agency being alone responsible for the spread of the disease, one cannot but think that rats, monkeys, and squirrels have been accorded rather hasty condemnation. In any case the above cases serve to show the utter want of precaution, among the villagers themselves, to check the epidemic.

23,594. Is it your opinion that human agency is, in the majority of cases, the cause of infection?—It is my opinion that it is the cause of infection in all cases.

23,595. Your experience is that infection is never taken a great distance by any other agency?—That is my opinion.

23,596. Do rats move much from place to place?—As far as I can make out they never move out of the village. I have asked the question a hundred times, but I can get no single record of the rats ever leaving a village.

23,597. It has sometimes been asserted that the rats move off when there is plague; you do not think they leave the village?—No, they may run to one end, but I think they run back again.

23,598. Do you think that when a village becomes infected the rat tribe is exterminated there during the outbreak?—I think it must be. I saw a curious case the other day when I to went to dig up one of those houses to get earth from the floor to send to Bombay. There was one particular spot in the corner of a room where three people had slept who had been attacked by plague one after another. The house had been ventilated but not properly—a little light had got in. The only part of the floor which has been attacked by rats was the very place where these particular cases had occurred. Whether they had been trying to escape or not I do not know.

23,599. Are field rats ever infected?—I have never seen it myself. I give examples in my précis.

23,600. Those examples are not your own?—No.

23,601. Do you place any reliance upon them?—I think it is possible that field rats might be infected, but I do not think they spread the infection. Some native officials have told me that field rats have been infected.

23,602. Are field rats ever found inside villages?—Never inside the houses.

23,603. You do not find house rats in the camps?—Not a single example.

23,604. Have you noticed the infection among any other animals?—I have not noticed it myself, but I have had reports of monkeys.

23,605. Which kind of monkey?—The brown monkey.

23,606. Do you think that there is any reason why a brown monkey should take the infection more than the grey one?—Because the brown monkey lives about houses; he moves about the roofs, and if he can get a chance he will go inside to steal food, which the grey one will not do, being somewhat timid.

23,607. In connexion with infection by human agency, have you had any experience which would show you that particular classes have been to a large extent responsible for taking the plague from place to place?—As far as my experience goes it is the trading classes who are permitted under the "Spence Committee rule"* to travel. I cannot say that they have carried it more than other people, but in my experience they have been the people who have largely taken the disease from place to place.

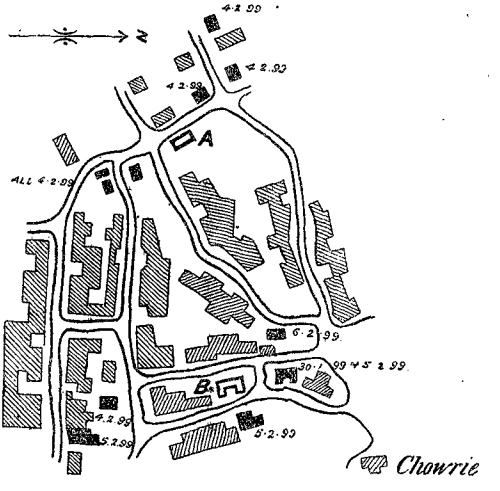
23,608. Can you give us any figures with regard to them?—Referring to the likelihood of plague being spread by small traders, the following figures showing the employments of persons attacked at Gadag in December 1898, are interesting. There were in all 11 cases, of which five were traders, two goldsmiths, three females, and one was a labourer. The total number of traders in the town is about 100 in a population of between 4,000 and 5,000. It will be seen that seven of the 11 cases occurred in the travelling classes.

23,609. Do you think that it is possible by any system of passes to prevent free inter-communication from place to place?—I think it may be done in time. Free inter-communication may cease when the village officers understand its danger, and when villagers who can be absolutely proved to have introduced plague into their own village are punished.

23,610. I suppose you would mainly rely upon the people themselves, who would be desirous of excluding such persons?—Yes, we must depend upon them because we have not the staff to undertake the supervision. All uninfected villages are warned against the admission of strangers or persons from infected areas.

23,611. There is no Government agency to undertake the duty?—Not on a sufficient scale. The ward system is in force, the ward men being, as far as possible, Government servants. Nevertheless, thoroughly effective supervision is impossible.

23,612. Have you investigated in any way the question of the manner in which rats take plague about in a village?—I give an instance of the village of Kotur which was infected on the 30th of January 1899. Where plague attacks a village for the first time, I think that, given a sufficient interval for the rats to infect one another, the whole village site will finally become infected. In this district evacuation has usually been so rapid that instances of general infection of a village area are not to be had. But one interesting example of partial infection of this sort has just come to my notice. The village concerned is Kotur which has been referred to above. Here plague appeared probably about the 27th of January, but owing to concealment of the disease no steps towards a general evacuation were taken until the 7th of February 1899. Below is a rough plan of the village:—



Rough Plan of the Village of Kotur
Scale - About 1 inch = 100 yards

The houses marked black are those in which plague cases occurred, those outlined in black are those in which a rat-fall occurred. The dates given are those on which the patients died, having been taken ill probably on an average of four days earlier. The group of houses in black to the west are all inhabited by low-caste families, and those to the east all by high-caste families. In the western group house, it was the first in which a rat-fall occurred, exact date not known, while in the house just north of house B a rat-fall

* Bombay Government Notification, No. 5391/3495, dated 5-10-97) not published with the Commissioner's Proceedings.

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occurred on the 27th anuary. In house B there was a rat-fall on the 4th February, but it was at once vacated. The peculiarity here is that the deaths occurred all on the same day in the western group, and the majority on the same day in the eastern group; the dates of seizure were not kept by the village officers, but they may be assumed to have been about four days earlier in each case. For so many houses to have become infected simultaneously other than human agency must have assisted in spreading the disease. The inhabitants of the western group are of the shepherd class, and have absolutely no dealings with the Lingayats of the eastern group. There would appear to be little doubt that rats were the agency for the spread of infection. In the map the direction of the wind has been omitted; it was due east, that is, running straight up the page, while infection travelled north and south.

23,613. Where was the infection?—There was a double infection.

23,614. On which sides of the village?—On the east and west sides. In the western part of the village infection was spread purely by rats. Infection originated through importation in the house marked A, and here mortality among rats occurred first of all, though there were no cases, because the house was at once evacuated; but deaths were simultaneous among the other houses in that part of the village, showing the infection had been evenly diffused and evidently carried by rats.

23,615. How far was the house infected upon the west side from the nearest house infected on the east side?—About 160 yards.

23,616. This interval did not get infected at all?—It remained uninfected up to evacuation.

23,617. You then evacuated the village?—Yes, on the 7th of February.

23,618. Was there no personal communication between the inhabitants of the village?—It is very possible, as in the western infected area they are all of the same caste—shepherds.

23,619. Then is it absolutely conclusive that the rats did move on the western side of the village?—No, but I deduce that they did from the similarity of dates of deaths in these houses. I do not think that these people could have collected together so as to have become infected all on the same date.

23,620. How many houses were infected on the same date?—The date of attack was not registered, but only the date of deaths; but the attacks were probably about the same period. The deaths were all on the same day in six houses.

23,621. At the eastern end of the village how many houses were attacked?—There were five houses attacked.

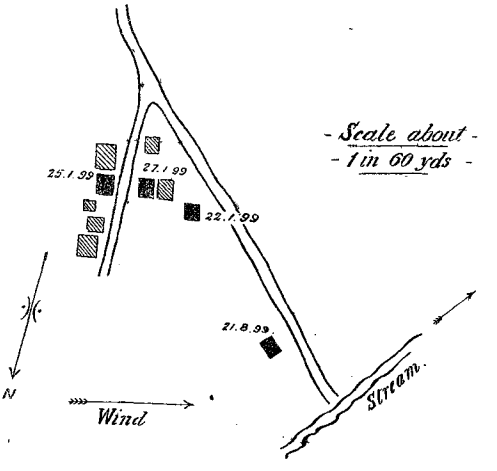
23,622. Did the deaths take place simultaneously in those houses?—Not quite simultaneously—they were on the 4th, 5th, and 6th February, and one attack which was not returned, but which must have been plague, was on the 30th January, giving two attacks in the same house within an interval of five days.

23,623. Would it not have been possible for this plague case on the 30th January to have given infection to the other people?—Of course, it is possible, but I do not think it is likely, because the people in the eastern group of houses were of high caste and they had no relations with the low castes on the western side.

23,624. In the particular side with which we are dealing now you have deaths on the 4th, 5th, and 6th. Could not the case which took place on the 30th have given the infection to all those people on the 4th, 5th, and 6th?—Yes, that is very likely; that might have happened. But to show that rats were spreading infection, there is the house marked B, in which rats were found dead and the people evacuating at once did not get plague.

23,625. Did they leave before these deaths had taken place?—I was there on the 7th and they were gone then. I could not say the exact day they left.

23,626. You have said that house rats do not exist in the camps. Have you been able to observe the manner in which infection is carried about in camps?—I give the example of Kotbagi to which the plan below relates:—



At the first glance this would look like local infection also, but as a matter of fact, the disease was communicated by human agency alone. The disease first appeared in the house nearest the stream which furnished the water supply of the group of huts. This case was reported as a seizure and death on the 21st January, but one of the contacts confessed that the patient had been ill for three or four days before the 21st, and that the inmates of the houses infected on the 22nd, 25th, and 27th, when going to draw water, used to come into the hut and sit with the patient. In this respect the women were the greatest culprits and it was their custom to remain with the plague patient for half an hour or more at a time. It is generally the case that in a group of villagers' huts those in which plague has occurred are close together, generally 5 to 10 yards and seldom more than 30. But for all that the locality is not infected as, more often than not, there are uninfected huts between those in which plague has appeared. Infection is spread by the people themselves, especially by the women, who cannot resist the temptation of paying a visit to the invalid just to see whether he has plague or not. There was a hut at Amibhavi in which a plague case had occurred; the hut was emptied of all property, the patient and contacts removed, and the roof pulled off. This had no sooner been done than a relation of the patient promptly annexed the dismantled hut and used it as a cattle-shed, while he turned an unoccupied corner into a cook-house for himself,

To cite another example. A certain roomy hut at Aminbhavi stood quite alone in a field some 200 yards distant from the rest of the group. In this hut lived seven members of a family, of whom five died of plague. Two women, connections of the family, visited the patients, contracted the plague, and carried it to other groups of huts, and another relative carried the disease to another village. The original hut was vacated on the first case occurring, but the contacts did not again move when the disease re-appeared among them. As between villages, so between huts or groups of huts, the spread of infection can always be traced to human agency; and among camps it would appear that there is no such thing as infection of locality, mainly because there are, as a rule, no rats to carry infection, or because the field rats are not so liable to the disease as the house variety. Sun-light and free circulation of air are also factors to be reckoned with. It is not easy to obtain cases of the continuance of the disease in camps being due to persons secretly re-visiting the infected village site for, unless such persons are caught *flagrante delicto* they will not confess. Personally, I have only come across one case of the sort, where a villager at Shirguppi returned secretly to his house one evening, a few days after the village had been evacuated, and was found there with plague next day; he stated that he was not ill when he re-entered his house, but the truth of his assertion is doubtful.

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23,627. Do you know whether these people got pneumonic or bubonic plague?—Bubonic.

23,628. Are you of opinion that plague can only be checked by isolating infected areas?—Yes.

23,629. How would you propose to do that?—That is a question that I have hardly thought out yet. If the villagers can be brought to understand that it is to their advantage to keep to their own villages and are punished for leaving, I think it can be managed. There is punishment for the village officers, but I do not think the mufassil plague rules lay down any punishment for the individual who introduces plague into his own village. I think such persons should be punished heavily, and that a few examples would make a great difference.

(Witness withdrew.)

Mr. J. L. Lushington called and examined.

Mr. J. L. Lushington.

23,630. (*The President.*) I believe you are in the Revenue Survey Department?—I used to be, but I am now Superintendent of Land Records and Agriculture.

23,631. You have been at Bijapur?—Yes.

23,632. (*Mr Cumine.*) You have had experience in two districts, Bijapur and Dharwar?—Yes.

23,633. Whilst you were in the Bijapur District the only place which got infected was Kaladgi, I believe?—Yes.

23,634. Where is the infection supposed to have come from?—From Sholapur.

23,635. Will you describe what was done in Kaladgi?—Towards the end of February the death-rate of the town of Kaladgi having increased, Assistant-Surgeon Mr. Redkar was sent down to find out the cause; he said there was plague, and I myself at once proceeded to Kaladgi. The place was at once evacuated, plague cases were taken to a hospital, and contacts to a contact hospital. A field census was made, and Circle Inspectors went round to find out cases every day in the fields. Disinfection was first made in every plague-stricken house and each house adjoining, and when that was finished the remaining houses (left out) in the street were disinfected and whitewashed. To the best of my recollection we did two whole streets and three or four separated houses. The rest of the town was then dry-brushed down and the houses cleaned. There were only about 26 cases in all, of which from eight to 10 took place after evacuation. Evacuation lasted until the beginning of May, when the people returned to their houses, and after return there were no cases; besides this, plague did not spread to other villages. All the roads of Bagalkot were patrolled to prevent people from Kaladgi entering secretly, Bagalkot being the large town of the district.

23,636. This was an instance of the successful stamping out of the plague?—Yes.

23,637. At its first appearance in a district?—Yes.

23,638. When were you transferred to the Dharwar district?—2nd December 1898.

23,639. What part of the district came under your charge for plague purposes?—East Navalgund and the west of Ron taluka.

23,640. How many infected villages have you under you at the present moment?—About seven or eight.

23,641. What is the area covered by them?—The two talukas join each other. The area is about 20 miles by 20 miles, or rather more.

23,642. What is your means of keeping a watch upon the mortality in the uninfected villages?—A weekly statement of deaths is sent in from the uninfected villages, and also a statement of sicknesses, which goes in weekly.

23,643. To whom?—To the Mamlatdar.

23,644. How many days after the close of the week does it reach you?—It ought to reach me the next day if I am in the same taluka. There is an extra day's delay if I am in the next taluka.

23,645. It ought to reach you on the day after the close of the week that it refers to?—It is sent in on Saturday; it would get to the Mamlatdar on the Sunday, and I ought to get it on the Monday evening.

23,646. To what extent are the people alive to the danger of admitting possibly infected people into their villages? Can they be relied upon to protect themselves against the entering into their villages of infected people?—No, they will let in relatives wherever they can.

23,647. When a village has become infected what do you think is the best way to treat it?—By prompt evacuation.

23,648. Is evacuation practicable without great hardship to the people during the rains?—In black cotton soil it would be a great hardship, but possibly in some of the western talukas, where they are more accustomed to rain, and have usually huts of their own on the borders of the jungle, it would not be such a hardship.

23,649. In what sort of soil does the plague rage most fiercely according to your observation?—In black soil.

23,650. Can you give any explanation of that?—Even now, in digging for foundations, 14 or 15 inches down the soil is found sufficiently moist to be able to make up a kind of clay balls.

23,651. So that you think it is the moisture that is the cause?—Black soil is a retentive soil, very clayey; I think that is the cause.

23,652. Have you noticed that villages along the banks of a river are more liable to infection than others?—Not necessarily, I think.

23,653. Do you find you can look thoroughly after the villages committed to your care? On an average, how many times can you visit each village?—I have to look after all uninfected villages as well. I, myself, go about once in 20 days to each village.

23,654. Do the people understand the danger of revisiting their evacuated houses? Will they boycott anyone who does it?—No, certainly not.

23,655. When a village gets infected, whom do you place there to look after it?—Whether it is infected or uninfected, it is under a Circle Inspector. He has a group of villages, some of which are uninfected and some infected.

23,656. Who remains on the spot to look after it?—Nobody except the village officers, but the Circle Inspector ought to be there directly he hears of a case, which will probably be the next day. I myself have given strict orders that they are to remain there for a day or two if plague is at all bad instead of going on to another village.

23,657. From what place did the infection of your villages come?—A tremendous number were infected before I got there. I started with 20 villages. My first weekly return in Navalgund showed 260 attacks in the 20 villages.

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23,658. Before you left Bijapur, had the epidemic appeared in Ilkal?—No. It did not get to Ilkal for three or four months afterwards. I took it over a free district, and left it a free district.

23,659. Do you know where it came from to Ilkal?—No.

23,660. If no European remains at hand, will the people of an evacuated village obtain for themselves the full benefit of evacuation by isolating the sick persons and preventing anybody from reimporting infection from the evacuated site?—I think a European is necessary.

23,661. Have you found disinfection with perchloride of mercury efficient in destroying the germ?—I have only had experience in one place, at Kaladgi, in Bijapur, and in that one case it was successful. Since that I have had disinfection going on in my villages and two of my small towns, but the people have not re-entered yet.

23,662. Is there any other form of disinfection which you have found useful?—I am in great favour of dryness and ventilation; not a scrap of water should be in a house. My plan of ventilation has been that a strip taken off the roof in every room—the theory is a 4-foot strip, but when rooms are narrow it has been less. The chief thing, however, is the 4-foot square hole in the wall. The sun and wind gets into that, especially the latter, and creates a thorough drying draught through the hole in the wall and out of the strip in the roof.

23,663. Have you any reason to believe that that is practically efficient in killing the germs?—I have no proof of it yet.

23,664. (*The President.*) You have one case of chemical disinfection with a satisfactory result?—Yes.

23,665. What did you do besides disinfection?—We evacuated the town, and disinfected the streets in which the plague occurred. After that we brushed down and whitewashed the rest of the houses. We only disinfected certain streets in which plague had occurred.

23,666. Did you open the roofs?—In a very small way. The doors, of course, were opened out and the roofs slightly ventilated.

23,667. How long were the houses kept unoccupied?—For two months.

23,668. What was the largest village you have managed to get evacuated?—A village of 9,000 inhabitants.

23,669. Was that successful?—It had been commenced by the person whom I succeeded; it was not thoroughly evacuated. When I came down I finished it off.

23,670. You had the whole of that village out?—Yes; they are out now.

23,671. Do you think it is feasible to evacuate a larger village than that?—Yes, with a little time. The last people in a village are the most difficult to evacuate and I got all those out.

23,672. How long did you take to get out this village with 9,000 inhabitants?—It was partially done before I got there, and so I cannot say.

23,673. How long does it take to evacuate a village?—About three days per 1,000.

23,674. You mean in fine weather?—Yes.

23,675. (*Mr. Cumine.*) Are there any complaints of theft of property in evacuated houses?—They have tried to burn houses. There is no property in the villages. I have everything taken out—cotton, grain, bags, everything. There is a little loose grain left sometimes.

23,676. Have there been complaints of theft of rupees?—I have not heard of any thefts, but they have tried to burn the houses.

23,677. Have any villagers asked for disinfection?—The villagers of Nalawadi, Navalgund taluke, requested that their village might be disinfected, or that I would sell them perchloride of mercury to disinfect the village themselves. As the disinfecting inspectors were working elsewhere I was unable to accede to their first request, and I did not comply with their second as I did not like to hand over so much poison to the people.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Collector's Office, Belgaum.

SIXTIETH DAY.

Friday, 3rd March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., L.L.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. Foy, M.B.
3 March 1899.

Mr. FOY, M.B., called and examined.

23,678. (*The President.*) You are a Bachelor of Medicine and Master of Surgery of Aberdeen University?—Yes.

23,679. In what place have you been occupied in plague work?—In Bombay, Karachi, and in Gadag Betigeri.

23,680. You have some information with reference to the value of inoculation during a plague epidemic I think?—Yes, with reference to a place not getting so depopulated; that is the point I wish to mention. The town of Gadag Betigeri in the Dharwar district consisted according to the census of 1891 of 23,000 inhabitants. This fell by the 11th of February 1899, about four months after the epidemic, to only 12,400. Gadag which is separated from Betigeri by about a mile of open land was the first part where plague broke out. Prior to the outbreak of plague about 2,500 of the inhabitants of Gadag (which nearly equally with Betigeri shares the number of inhabitants) were once inoculated, and 365 of these twice, and more would have been inoculated had not the supply of serum failed them. With the appearance of plague there was a further rush for inoculation and a large number were inoculated before the epidemic had taken a very strong hold, and to prevent having themselves evacuated from their homes. A month after the epidemic had appeared the numbers of the inoculated were doubled, nearly

3,250 having undergone single and 1,720 double inoculation, and even these numbers would have been greater but for the short supply of lymph at that time. The epidemic began to spread in Betigeri about two months after its start in Gadag, although sporadic cases had already occurred there, the number of those who were once inoculated in Gadag Betigeri now being 6,179 and those twice inoculated 5,686. By this time the disease had got to its height at Gadag. The residents of this part of the town being mainly agriculturists had moved to huts erected on their fields, partly voluntarily and partly as a result of plague measures, (those who moved voluntarily included some of the inoculated), so that Gadag on the whole presented a very empty aspect. Many of the shops were closed, the Marwaris all left the town, the agriculturists were encamped on their fields, and the tradesmen and bankers had left for other uninfected places. Betigeri on the other hand learned by the example of Gadag. The people in it were mostly of the weaver class and although their work has suffered in the general panic it has not been entirely stopped. The people of Betigeri made a great rush for inoculation and thus avoided the general evacuation of the town by getting all the inmates of their houses inoculated. The consequence is that the main street of Betigeri has already presented a busy aspect, the shops remaining open, and some amount of trade is carried on. That the greater part of this good result may be put down to the feeling of safety produced by inoculation is shown by the fact that of the 12,426 occupants of Gadag Betigeri on 11th February 1899 as many as 11,703 were inoculated, 10,994 being twice inoculated.

23,681. Can you go further, and give us any facts which will show whether in addition to the checking of panic the spread of the epidemic was appreciably affected?—I am sorry I cannot give any opinion with regard to that point.

23,682. You have had a good deal of experience of hospital treatment?—Yes.

23,683. Were you in charge of some hospital?—Yes, of the Plague Hospital at Gadag.

23,684. Had you any opportunities of seeing whether the friends who attended the patients in the hospital became affected?—Of all the friends only three were affected.

23,685. Whether they were inoculated, or not inoculated?—Quite so. We had three cases amongst those who were attending on their friends. These three cases were all uninoculated.

23,686. Out of how many?—We had 334 admissions, and each patient had a friend if they liked. I suppose about 50 may not have had any friends with them. To 291 admissions we have a record of 117 friends, but all the inoculated friends were not recorded.

23,687. Had every patient one friend only, or more?—One only.

23,688. They were therefore a smaller number than the patients?—Yes, smaller; and there were three attacks among them.

23,689. In reference to the hospital servants did they become infected?—We had no attacks among them.

23,690. Were they inoculated?—The majority of them were, but not all.

23,691. Can you distinguish the numbers of those who were and those who were not?—There were six out of 23 who were uninoculated, one was once and 16 were twice inoculated.

23,692. How many out of the total admissions died within 24 hours after admission?—Sixty out of 334 died within 24 hours of admission into the hospital.

23,693. Have you any facts as regards the incubation period from your experience with the segregated contacts?—I have worked this out by adding the number of days after admission to the contact camp that the contact took the plague, and adding that to the number of days before their admission that their friend in the house had been attacked, that is to say I add together the number of days during which the contact was exposed to infection to the number of days within which he developed plague after his admission to the contact camp. I got the following figures:—

1 day	1 case.
2 days	2 cases.
3 days	1 case.
4 days	5 cases.
5 days	2 cases.
6 days	3 cases.
7 days	5 cases.
8 days	4 cases.
9 days	1 case.
10 days	1 case.
11 days	2 cases.
12 days	2 cases.
13 days	1 case.
16 days	1 case.
17 days	1 cases.
18 days	2 cases.

If the time after admission to the contact camp which the patients took to develop plague in the above is taken, I get the following figures:—

1 day	1 case.
2 days	6 cases.
3 days	5 cases.
4 days	6 cases.
5 days	10 cases.
6 days	2 cases.
7 days	2 cases.
8 days	1 case.
9 days	1 case.
10 days	0 case.

This method alone does not eliminate the fact that the patient may have been exposed to infection and undergoing incubation some days before admission to the contact camp, whereas the other method quoted is open to the objection that the patient may have received infection from other persons than his friend. On the whole, however, it is unlikely that he should get infection from others than those in whose company he is constantly found.

23,694. What have you to say about the reduction of mortality under treatment in the inoculated, as contrasted with the uninoculated persons?—In the uninoculated 29 per cent., that is 54 out of 184 recovered. Among the once inoculated we had 17 out of 32 recovered, giving a percentage of 53. There were six per cent. still under treatment when these figures were taken.

23,695. Still in a precarious condition?—They were still under treatment in hospital; they had not recovered. Among the twice inoculated 34 out of 75 recovered, being a percentage of 45. 21 cases were still under treatment, making a percentage of 28.

23,696. What have you to say with regard to the clinical aspect of plague among the inoculated? Is there any difference in the case of the inoculated patient as contrasted with the non-inoculated patient?—Yes. The symptoms are of a milder type. Symptoms such as delirium, moreover, are not usually met with in the inoculated. Delirium occurred in 99 out of 184 uninoculated cases, nearly 54 per cent.; while among 107 inoculated cases only 24 had delirium, or 22 per cent. Of the 75 twice inoculated only 17 had delirium, while of the 32 once inoculated, only 7 suffered with it.

23,697. What have you to say with regard to the almost complete absence of evil effects of inoculation which you mention in your précis?—Practically, that evil effects have been almost absent. There are a few evil effects of inoculation, of which I have some notes here.

23,698. What were the chief evil effects?—In a few cases prolonged fever.

23,699. Of how many days?—About 10 days after inoculation.

23,700. A continued fever for 10 days?—Yes, a low fever of 100 or 101. In some there was hyper-pyrexia, and in some vomiting.

23,701. With regard to the hyper-pyrexia, that was not long continued?—No.

23,702. What do you mean by hyper-pyrexia?—Over 103 or 105.

23,703. Hyper-pyrexia, as you well know, is a very serious condition. At what temperature do you term it hyper-pyrexia?—The general experience has been that anything over 103 is not what usually occurs after inoculation.

23,704. Is it an abnormal height? I should not term it hyper-pyrexia, because that is very serious. In how many cases did you have a temperature above 103?—Two.

23,705. In those two cases what was the maximum temperature?—105.

23,706. How long did it last?—About the usual time, two days. Of course, ordinarily, pyrexia is not termed hyper-pyrexia till it reaches 107.

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23,707. What other evil effects did you notice?—Severe pains in the muscles and joints in two cases, very severe pains, and they had to lay up for three or four days. There was severe purging in two cases; and at the time of the operation fainting has been observed more in men than in women.

23,708. Have you encountered plague in the same person more than once?—One case.

23,709. How often?—Two attacks.

23,710. Would you give us a few facts about that one case?—This case had come from an infected house in the town. This woman, a Brahman, and the wife of a local pleader, first came to the hospital from an infected house in the town. She then had a small bubo in the right femoral region. A relative of hers had died in the house, and another was brought into the hospital. All were twice inoculated.

23,711. Were these relations living in the same house?—Yes. Her symptoms were of the mildest, the fever having subsided before admission to hospital, and never rising above normal again, except the afternoon of the second day, and she left the hospital in five days, the bubo subsiding entirely under local treatment. She then continued well for eight days, when she was re-admitted to the hospital with a bubo in the right axilla.

23,712. Have you a clinical chart of this case?—Yes. I have the admission and re-admission chart. The original chart is not complete as the patient had some fever prior to admission. The highest temperature recorded each time was 103.

23,713. Did the patient remain in the hospital in the interval between these two attacks?—No, she did not; she went away to the fields.

23,714. How long was she in the fields?—It was only eight days.

23,715. Before she left she was continuously exposed to plague, I suppose?—She was in the hospital in a separate hut practically.

23,716. Does it occur to you this might be a relapse? You would not express an opinion either one way or another?—I would say it was a second attack.

23,717. A re-infection?—Yes, a re-infection from outside.

23,718. What is your idea of the duration of the immunity produced by inoculation?—With reference to those attacked, the duration of immunity is 50 days.

23,719. After inoculation you think they are no longer safe after the period of 50 days has expired?—Yes.

23,720. Why?—Because they have come into the hospital with plague after that time.

23,721. Can you give us some special case?—There were 31 cases that came to hospital between 10 and 50 days after inoculation; 50 between 51 and 60 days; 21 between 60 and 90 days; 5 between 91 and a 120 days; 2 between a 120 and a 150; and 1 between a 151 and 180. 180 days was the maximum. There were 10 after single inoculation, and 5 after double inoculation in the first 10 days.

23,722. You observe what this may show: that the immunity may only last for 10 days, and that those who acquired plague after 10 days, were not in a position to be infected till that time; the immunity in all these cases above 10 days being lost in the 10 days. If it shows anything it shows that 10 days is the period of preservation?—That is why I ask you to take those attacked and those not attacked. If you take 100 cases out of 10,000, there are 9,900 unattacked the whole six months and longer.

23,723. Then you cannot say anything as to the period of immunity?—I can say it is over six months in the vast majority of cases.

23,724. What proportion of the people stayed in Gadag Betigeri, and what proportion went away?—The total number that have stayed is about 12,500, in the two places combined, out of a population of 23,000.

23,725. What is the total number of cases, and the total number of deaths reported among those who remained?—About 280 deaths out of 400 cases.

23,726. Have you any idea of the number of inoculated persons out of the 12,500 who remained?—About 12,000.

23,727. Practically the whole of them?—Yes. The following table gives details:—

TABLE of ATTACKS and DEATHS, with the Population on the same Date at different Stages of the EPIDEMIC of PLAGUE, comparing the Figures for the two Divisions of the Town of GADAG-BETIGERI. The greater part of Betigeri being inoculated comparatively sooner than Gadag led to its being less completely emptied.

Month and Date.	Description of Figures.	Gadag.				Betigeri.				Totals of Both.				Remarks.
		Uninoculated.	Once.	Twice.	Total.	Uninoculated.	Once.	Twice.	Total.	Uninoculated.	Once.	Twice.	Grand Totals.	
		About	About	About	About	About	About	About	About	About	About *	About *	About	
To 15 Oct. 1898.	Population	10,900	1,785	315	13,000	12,600	350	50	13,000	23,500	2,135	365	26,000	Cannot be given exactly. * These figures were taken from inoculation registers. Some few of the numbers given may have left the town. The remaining figures are only approximate. The figures for Gadag and Betigeri separately are unrecorded; approximate ones only are given.
	Attacks	12	—	—	12	—	—	—	—	12	—	—	12	
	Deaths	7	—	—	7	—	—	—	—	7	—	—	7	
		About	About	About	About	About	About	About	About					
From 15 Oct. to 18 Nov. 1898.	Population	8,643	2,060	1,516	12,169	12,760	560	180	12,900	20,813	2,560	1,696	25,069	
	Attacks	36	2	0	38	0	0	0	0	36	2	0	38	
	Deaths	29	—	—	—	1	0	0	1	30	0	0	30	
From 18 Nov. to 16 Dec. 1898.	Population	2,640	1,812	3,887	8,339	9,132	1,796	1,299	12,227	11,772	3,608	5,186	20,566	
	Attacks	64	7	11	82	6	0	0	6	70	7	11	88	
	Deaths	46	2	0	48	6	0	0	6	52	2	0	54	
From 16 Dec. 1898 to 13 Jan. 1899.	Population	500	381	4,306	5,187	2,135	1,524	5,148	8,807	2,635	1,905	9,454	13,994	
	Attacks	79	7	29	115	48	9	8	65	127	16	37	180	
	Deaths	74	4	11	89	34	3	5	39	105	7	16	128	
From 13 Jan. to 11 Feb. 1899.	Population	287	245	4,723	5,255	436	464	6,271	7,171	723	709	10,994	12,426	
	Attacks	13	2	20	35	29	8	36	65	42	10	56	100	
	Deaths	10	1	4	15	31	4	15	50	41	5	30	76	

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23,728. Did you do anything else besides inoculating the people?—We evacuated the houses where plague occurred, and the neighbouring houses.

23,729. What disinfection did you do?—We disinfected the place.

23,730. Any neighbouring places?—No.

23,731. How did you treat contacts?—Those who come from the infected house are the contacts; we cleared them into the contact camp.

23,732. Have you anything to say about the occurrence of plague in inoculated and uninoculated pregnant women?—I have had six cases. Of those four were inoculated and two uninoculated. The four inoculated all recovered, and the two uninoculated died.

23,733. What was the stage of the pregnancy in those cases?—The uninoculated were three and five months, and the inoculated were from seven to nine months. One of the inoculated went out of hospital without miscarrying. The others miscarried.

23,734. Is it a more serious matter for a woman to miscarry within three or four months, as contrasted with from six to eight months? Apart from plague altogether, which is the more serious?—The later period in pregnant women attacked with plague, the earlier in non-plague cases.

23,735. (*Mr. Hewett.*) Did you keep a record of the average temperature of the 7,300 persons whom you inoculated?—No.

23,736. With regard to the three persons infected while attending on friends in hospital, can you give in each case how many days after arrival in hospital they were infected?—In one case I remember clearly it was the fourth day, another case took ill the next day, and another the same day.

23,737. Did any of the cases occur under such circumstances that they could not have brought the infection from outside?—To my mind they must have all brought it from outside.

23,738. On account of the number of days within which they caught it?—Yes.

23,739. Have you had any experience of the kiln process of disinfection?—Yes.

23,740. Where did you try it?—In the village of Lingdhal, and very nearly the same method in Karachi.

23,741. How many houses did you try it in?—It was tried in almost every house that was disinfected in Lingdhal, and I disinfected 228 houses (some of which were large compounds, and large houses containing from 10 to 40 rooms each) at Karachi.

23,742. Did the residents of the houses do it themselves, or was there some establishment for disinfecting?—The supervisor that went out there did it at Lingdhal, and the houses at Karachi were done under my personal supervision.

23,743. After it had been done, did any case of plague occur in any house which had been disinfected in this manner?—As the people were all in the fields at Lingdhal it has not been tried there, and as I was transferred from Karachi immediately after the disinfection was finished, I have no idea how the present epidemic is affecting the houses disinfected under my supervision.

23,744. Then you have had no idea of its nature?—No.

(Witness withdrew.)

Major T. H. Hardy, I.S.C.

Major T. H. HARDY, I.S.C. recalled and further examined.

23,745. (*The President.*) You have been on plague work at Dharwar, and you have been before us on a previous occasion?—Yes, I have been examined before.

23,746. I believe you wish to say something in addition to what you have already told us?—I said I could talk about the measures adopted for the re-admission of the inhabitants of Dharwar who were out in the huts. Dharwar was partially evacuated, and about 18,000 people went away in one week at the commencement of October. They feared segregation and inoculation, and gradually by the end of November 1898, the population was reduced to 9,800 odd. They were allowed to come back provided they were inoculated.

23,747. Was that the only requirement?—That was the only requirement at first. They gradually came back at the rate of about 500 or 600 a week, provided they were doubly inoculated. A notification to that effect was posted on every door, and if any persons went into their houses without this requirement being fulfilled they were prosecuted. I had to prosecute one person, and it resulted in a conviction. Each man who came back was given a pass (produced) signed by me; and the number of persons inhabiting the house was entered on it. I have a book containing a list of all vacated houses, and I insert how long they were vacated, how long unroofed, and the date upon which the house was re-occupied, together with any other remarks, such as disinfection, &c.

23,748. What was the minimun period that a house had remained unoccupied before these people came back?—The minimum was about a month. In the interval the house had been unroofed. At first, up to the middle of December, if a house had been unroofed and vacated for a month the people were allowed to come in without disinfection, but after that every empty house, whether unroofed or not, was disinfected with percholride of mercury.

23,749. Therefore also the majority were disinfected with chemical substances?—Yes.

23,750. I think you wish to tell us the general result of this re-occupation?—The general result of re-occupation is that there have been only two cases of plague as the people came back. These were traced to importation, one from Gadag, and the other from Navalur, a village 3 miles distant.

23,751. Previously infected houses, therefore, no longer conveyed infection to inoculated persons?—They have not done so, so far.

23,752. But these houses were probably themselves no longer capable of giving infection?—I do not think so.

23,753. What have you to say about the measures adopted after the abolition of inoculation?—The people petitioned with regard to the loss of trade, so the Collector asked me to frame rules for the re-admission of the people from the huts around. I had a census taken of all the people as far as I could get them. It took from the middle of December until the end of January to get. 8,148 people were found in the huts. I went round myself occasionally with the Hospital Assistant to find out where the plague was. We found out one or two cases, and we burned their huts. Latterly, however, there has been no plague there, and the people were allowed to come in provided they were disinfected in their huts.

23,754. They were allowed to return to their houses in Dharwar?—Yes.

23,755. Was the result different?—They were uninoculated. They did not suffer. Nothing has happened.

23,756. It shows nothing either for or against inoculation?—It shows that evacuation has done good in that case.

23,757. Have you anything additional to say about the disinfection of houses which has not already been described?—No, I have nothing more to say. We have rules now about the people coming in. Of course we can only account so far for about half the original population at Dharwar; about 19,000 people are unaccounted for. I have here the last census (produced) showing the state of Dharwar town.

23,758. The population is only about 20,000 at present?—Yes.

23,759. As contrasted with a normal population of what?—In June last the population was over 38,000.

23,760. (*Mr. Hewett.*) Where do you think that the remaining 19,000 persons have gone to?—They have scattered over the country; they are not in huts round Dharwar. I think a great many of them have died. In one set of huts I visited about a fortnight ago, on inquiries from the people I found that out of an area of

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about four acres there were from 40 to 50 huts, and I was informed that in every hut there had been cases of plague, with one or two deaths at least in each.

23,761. These were the huts of persons who had segregated themselves voluntarily?—Those who had voluntarily evacuated.

23,762. At what distance from Dharwar town?—These huts were about a mile from Dharwar, on the main road between Hubli and Kalghati.

23,763. At the present moment, could these 19,000 people come back without being inoculated?—That has been stopped. I have the orders here (produced) which are at present in force.

23,764. For how long have they been in force?—It has not yet been sent round the districts: I did not like to circulate it until I had the people in from the huts around.

23,765. Upon what terms are you going to re-admit the people?—I have had a notification published by the Collector of all the plague-infected places, and we have a system of guarantors for arrivals coming into force. Uninoculated persons coming from an infected district who cannot get a guarantor will be sent to the health camp. Those who are inoculated will be allowed to go at once.

23,766. Whether a person comes from an uninfected place or from an infected place, he will be allowed to occupy his house if he has a guarantor?—Yes. But his clothing is disinfected, should it be dirty, or if the volunteer at the railway station thinks he is likely to carry infection, his clothing is disinfected.

23,767. In your opinion what proportion of the Dharwar population that left the town occupied huts in the neighbourhood of the town?—One-third.

23,768. How many people would that leave to scatter themselves about the country?—About 19,000. I do not know how many of them are dead.

23,769. Do you consider that those 19,000 persons did scatter plague throughout the Dharwar district?—Yes, certainly. I do not say that all the 19,000 persons scattered the disease, but some of them must have done so.

23,770. In all probability they were very badly infected?—Yes; I know that a great many infected people went to the villages round about, and did scatter plague.

23,771. Do you keep the keys of the locks on the vacated houses?—No; we paste up a notice that the people are not to go into a particular house. We paste the notice over the lintel of the doorway, so that it cannot be opened without breaking the notification. The case I brought before the Magistrate had a very salutary effect, the people come up readily and asked for re-admission.

23,772. Do you now think, at Dharwar, that, provided that a house has been properly disinfected, and that the person returning to it is not likely to be himself incubating plague, or to be carrying the infection in, it is quite safe for him to come back to his house?—I think the results show that.

23,773. That is to say the authorities at Dharwar now attach more importance to disinfection than they did?—Yes; I think they do. It has been disinfection combined with evacuation of the houses. All the houses have been unroofed as well.

23,774. Your treatment of the houses, whether by unroofing them, or by opening them out and disinfecting them, has, in your opinion, destroyed the local contagion?—Undoubtedly; I do not say whether it is due to disinfection or the emptying up of the houses. The combination of the two has done it, I should think.

23,775. (*Mr. Cumins.*) To what extent have the people been now converted to believe in disinfection?—I do not know about belief in disinfection.

23,776. I am referring to chemical disinfection?—My own opinion is that the people had a lot of trouble owing to being kept out of their houses. When they heard they could come back without inoculation provided their houses were disinfected, they would have all come back in one day if they could. According to the rule, however, they were not allowed to come back until their houses were disinfected. I had any number of petitions from people asking me to disinfect their houses. I do not know whether they believe in disinfection or not. I should think it is probably the other way, but that they accepted disinfection as a means of re-admission to their houses.

23,777. (*The President.*) Have you had any experience of disinfection without chemical disinfectants, such as opening of houses?—Yes.

23,778. Can you give the result with regard to the destruction of the virus?—In Kelgeri, about 3 miles away from Dharwar, I had all the houses opened, the roofs taken off, and the doors taken off. Besides that I have had all the ground in the rooms dug up to the depth of about 3 inches and thrown out into the sun. The people themselves willingly come forward and lime-washed their houses. They have all gone back now, with no return of plague.

23,779. How many people or houses does that instance deal with?—One village of about 1,000 inhabitants.

23,780. You did not use mercuric chloride?—No; nothing.

23,781. Are these inoculated persons?—There were eight families inoculated in the village, and they have been occupying their houses all the time.

23,782. The majority were uninoculated?—Yes.

23,783. In the case of Dharwar, had you, before this large exodus took place, made any provision for the people who wished to leave the town?—There was only one health camp in the town capable of holding 1,000 people.

23,784. Therefore, of course there was no actual measure in operation which would prevent their scattering themselves?—The only measure was that the Government of India allowed them to get bamboos at about a quarter price to build huts with outside the town. There was a depôt at the Dharwar station for that purpose.

(Witness withdrew.)

Major R. H. Forman, R.A.M.C.

Major R. H. FORMAN, R.A.M.C., called and examined.

23,785. (*The President.*) I believe you are in the Royal Army Medical Corps?—Yes.

23,786. I understand that you have volunteered to bring before us some cases in which inoculation appears to have produced good effects?—Yes.

23,787. Will you kindly state what you wish to say?—There were two groups of cases that I inoculated when plague first broke out in Belgaum with whom I have been able to keep in touch since. The two groups were amongst my own private servants in my own bungalow, and my hospital attendants with their wives and children in the Station Hospital at Belgaum. Of my private servants there were in all, including their wives and children, 28 people inoculated. There have been no cases of plague, and no deaths up to date. There were three uninoculated. One was a child of nine years of age, whose father refused to allow it to be inoculated. It died of plague 12 days after the other people were inoculated. I diagnosed the case myself as plague.

23,788. How long after?—The child got plague and died 12 days after the servants were inoculated. They were inoculated in December 1897.

23,789. The child was not ill at the time?—No, it was perfectly well. The other two cases that were not inoculated were not so distinctly under my own observation. One was a sweeper employed in the Cantonment as a Municipal sweeper, the husband of my sweeper woman, and sleeping in my compound. He, I am told, died of plague some months afterwards. He was not inoculated. The other was my bhisti. He threw himself into a well. I was informed that he had buboes and fever, and ran away to escape segregation. Of the 28 inoculated none died of plague, and of three uninoculated two are said to have died of plague, and one undoubtedly died of plague.

23,790. Were these people living in the compound?—Yes, except the bhisti.

23,791. How was the infection conveyed to the people; how did they become infected?—I do not

know. Plague was raging in the bazar close by. The bungalow was within a quarter of a mile of the Sadr Bazar.

23,792. Were there any rats?—There were rats about the bungalow, but I did not see any dead rats. All around the bungalow there were cases of plague and deaths.

23,793. Where were the servants living?—In my compound. I disinfected the houses myself.

23,794. When; at the time of inoculation, or before or after?—I do not know whether it was before or after. On further consideration, I am sure the houses were disinfected both before and after.

23,795. So that in addition to inoculation there was thorough disinfection?—Yes, they were all slushed down with perchloride of mercury, and the roof taken off.

23,796. Presumably the originally infective cause had been removed by disinfection?—Possibly so. I may mention that amongst my servants I found there was one woman who was inoculated who had died in a village, but it was said not to be of plague. I know that the woman many months before was the subject of malarial fever. She had an enlarged spleen and an enlarged liver. I know that from my own observation. I hesitated whether I should inoculate her at the time I think the statement that she did not have plague is true.

23,797. What other instances have you?—My hospital servants. These are under my own supervision. There were altogether 87 inoculated, of which 79 were continually resident in the place. Eight were there during the day only, and went home at night.

23,798. What was the total number of hospital attendants?—Ninety. Eighty-seven of these were inoculated. Since then of the inoculated (87) there has been one death, a daughter of one of the men, but she did not die of plague. She died of rheumatic fever and endocarditis. Of the three who were not inoculated, two were not inoculated because they were pregnant, at least, one had recently been delivered, and the other was pregnant. The third was a boy sixteen years of age, whose father refused to let him be inoculated. One of the uninoculated women has not had plague, she is alive now. The boy whose father refused to let him be inoculated died of plague on the 22nd February 1898, less than two months after the other people had been inoculated. The other woman died on the 24th of February, 1898. She also died of plague. She had been in attendance upon the boy.

23,799. Therefore two of these three died?—Yes. There were only three uninoculated, and two of them died. The houses were then evacuated for ten days, and disinfected. The people went back to them, and there has been no more plague in them since.

23,800. These houses, however, were occupied by 87 inoculated and three uninoculated people?—No. Eight of the people that were inoculated did not live in the houses. Seventy-nine of the inoculated, and the three uninoculated were always resident in the place.

23,801. When did these plague cases occur, nearly at the same time, or at different times?—One death took place on the 22nd of February 1898, and the other on the 24th of February 1898, two months after the other people were inoculated. The inoculation date was the 28th and 29th of December 1897.

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23,802. (*Mr. Hewett.*) Referring to the first group (28 cases), did the disinfection of your vacant houses take place before the child that died of plague took plague?—Yes, they had been disinfected before, several times, I think, but once, I am certain.

23,803. How many other residents were there in the particular house in which the child died of plague?—Three, father, mother, and the child. The child died in the segregation camp. The father and mother were allowed to go with it, but returned immediately after its death, and lived among the rest of the servants.

23,804. Among the people that you inoculated were there any persons over the age of 50 or 60?—Yes, two. One in the 28 group and one in the 87 group. The former was the father of my cook, an old crippled man; he is alive and well now. The latter was the mother of one of my hospital attendants. She left eight months ago, and died in Madras some six months ago. The cause of death is unknown to me, but her son states it was not from plague. I understand there was no plague in Madras six or eight months ago.

23,805. In the group of 28, how many under the age of three did you inoculate?—There was one of two years of age, and two of four years of age. Of course the ages are approximate.

23,806. There were three under five?—There were three under five years of age.

23,807. The old woman was the only person among the inoculated in the group of 87 who has died?—That is the only death among the inoculated.

23,808. How many of the inoculated persons were under five?—I have not got the ages; I do not know, six at least.

23,809. Were any rejected because they were too old or too young?—No, none were rejected. We gave graduated doses according to age, sex, &c. My observations are summarised as follows:—

1st Group.—28 inoculated; 3 not inoculated.

Of the inoculated, one woman died in her own village several months afterwards. The cause of death is unknown, and said not to be plague, and the woman was a confirmed invalid. The others all well now, and have not suffered from plague.

Of the uninoculated, all died, one 12 days afterwards of undoubted plague, the other two of what was said to be plague. One of the latter did not live in the compound.

2nd Group.—87 inoculated; 3 uninoculated.

Of the inoculated, one died some months thereafter of rheumatic fever and endocarditis, and one woman died in Madras six months ago, but not of plague. The others are all well, and have not suffered from plague.

Of the uninoculated, two died within two months, both being undoubted cases of plague.

Thus in a total of 115 inoculated cases, there were no attacks, and in six uninoculated cases there were five attacks and five deaths, though two of them were only hearsay cases of plague.

(Witness withdrew.)

Miss A. M. Corthorn, M.B., re-called and further examined.

Miss A. M. Corthorn, M.B.

23,810. (*The President.*) You are prepared to give us some further information as to the results of 37,000 inoculations which you have done?—Yes, they are the inoculations of Gadag. Up to the 18th February there were 20,859 people inoculated, of whom 17,997 were inoculated for the second time; that gives a total number of inoculations of 38,856. It is a little over 39,000 now.

23,811. Have you come to any conclusion with reference to these inoculated persons as to the interval which occurs between inoculation and plague?—I have worked that out for the Dharwar results, but not completely for the Gadag results; that is in process of construction.

23,812. Have you any information with regard to the dosage as influencing immunity?—I always give a larger dose than the prescribed dose, one-fifth more. When I came away from Dharwar there were 4,003 people who had been inoculated at the Civil Hospital, and 8,552 whom I had inoculated. I had inoculated more than twice as many as were inoculated at the Civil Hospital; 96 of the cases which I inoculated developed plague. A good many of those really came out because they fell within the incubation time, taking that as only 48 hours. Of the 4,003 who were inoculated at the Civil Hospital 78 got plague. Admitting all the cases, there were 96 cases amongst my 8,552 and 78 among the 4,003. In Gadag, out of the

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38,000 inoculations, I have done, roughly speaking, three-fourths, and Dr. Foy the remainder; 86 cases, so far, of the people whom I have inoculated have taken plague, and 66 of those whom Dr. Foy has inoculated. The only difference has been that I give larger doses than the other people who have been working with me. The plague incidence has been considerably smaller among the people I have inoculated than amongst those who have received the smaller doses.

23,813. Is there any relationship you wish to draw attention to between dosage and sex?—Women bear quite as strong doses as men; in fact, men react rather more than women do, that is, the higher temperatures have been observed in men.

23,814. I understand your practice is to make no difference between the two?—That is so.

23,815. Now, with regard to age?—Children get much larger doses in proportion to adults. I gave one-fifth of the dose to children under two, and got no reaction at all, and I found the same thing happened over and over again. I have no figures, but that is my general impression. When the child is brought for a second inoculation I say, "Was it bad the last time?" and the parents say, "No, not at all, he did not seem to feel it." So I have got into the way of giving a child of one year old 1 c.c. of the 2½ c.c. prophylactic, that is two-fifths of the standard dose, and a child of 12 has the standard dose.

23,816. Have you seen any case where the temperature did not rise?—Yes. I have not taken the temperatures in Gadag, but you cannot take temperatures when you are doing nearly 1,000 inoculations a day. The temperatures were only taken of those few cases at Hubli, regarding which I have submitted notes. (*See* Question No. 1,778.)

23,817. There is an enormous number of other cases where the temperature could not be taken?—Yes. I can only state the general impression that I have received by asking people at the time if they were bad at the first inoculation. I have made a practice of that. I am also working out a table, which is not yet complete, in regard to the interval between the first and second inoculation. I think that bears somewhat on the severity of the first reaction. I take it that a person who has had a very bad reaction will not be in a hurry to present himself for a second inoculation.

23,818. You have met with instances where there was no particular rise of temperature?—Yes.

23,819. Do you know whether any of those persons became infected?—There were no cases of plague among those people, but they were inoculated when plague was going down. They were inoculated in the Southern Mahratta Railway Lines in Hubli, and although there had been cases there before there were not cases after that time amongst the uninoculated. There were only a few uninoculated, but the plague had gone down very much. Therefore, the inference that those people who did not develop a temperature were still protected cannot be drawn.

23,820. In the case of second inoculations, did you have the same temperature reaction or a different one?—The general result was that the temperature was about the same. In a few cases I thought it was higher, that those who got it lower first got it higher afterwards; but when I worked out the figures it seemed about the same. Having a slight reaction the first time did not mean that they would have a big reaction the second time, and if they had a big reaction in the first place it did not follow that they would have a weak reaction in the second.

23,821. You did not have, in the second inoculation, cases where there was almost no rise?—No, not one.

23,822. It was exceptional to get only a low temperature?—Yes.

23,823. Were those people who were inoculated twice and who did not have a large rise of temperature equally protected?—I cannot say. I think the time at which the inoculations were done prevents one drawing any inference. I know they did not get plague, because I was able to follow them up; but plague was going down in that particular quarter of the town, and the inoculation may have had nothing to do with protecting them.

23,824. Have you done any third inoculations?—I have done some.

23,825. What was the temperature?—I have not been able to follow that up. They are people who come up to me in crowds. A good many people have asked to be inoculated a third time.

23,826. What is your opinion of the relative value of single and double inoculations?—In Dharwar it worked out largely in favour of double inoculations. We had a difference of 30 per cent. in the reduction of morbidity for the doubly inoculated, and about 18 per cent. in the reduction of mortality.

23,827. Have you got any further evidence on that point? Your case remains as it was before?—That is so. In Gadag, at present, it is not working out so largely in favour of the doubly inoculated as it did in Dharwar. The number of once inoculated present at any time as compared to the twice inoculated is so small that the comparison is a less valuable one than if they were present in about equal proportions. These charts* illustrate that, perhaps; they show the relative proportions of the three classes resident in the town, and the plague incidence among them.

23,828. You mean the three classes of once inoculated, twice inoculated, and uninoculated?—Yes. The black line represents the uninoculated, the blue line the once inoculated, and the red line the twice inoculated. The uprights give the proportion of cases in the corresponding column.

23,829. You have formed no opinion of the relation between the degree of temperature rise and the efficacy of the inoculation?—I have no figures on the point, but I have seen nothing to lead me to think those who have not reacted to the prophylactic are more apt to take the disease.

23,830. You are not in a position to say that, even independently of temperature rise, the efficacy may be the same, being rather the result of the dose, or the quantity, than of so-called reaction?—No.

23,831. (*Mr. Hewett.*) With reference to the statement prepared from the weekly reports which you have put in in your previous evidence, can you give us figures for Gadag which correspond with those given for Dharwar?—Yes; I have worked them out rather on different lines. I have tables prepared, as follows:—

STATEMENT from the WEEKLY CENSUS of the NUMBERS of UNINOCULATED, ONCE INOCULATED, and TWICE INOCULATED present in GADAG TOWN.

Week ending	Uninoculated.	Once Inoculated.	Twice Inoculated.	Total Population.
Nov. 19, 1898	20,213	2,580	1,696	25,069
„ 25, „	17,659 (75·5 %)	2,916 (12·9 %)	2,799 (11·9 %)	23,374
Dec. 2, „	15,473 (68·4 %)	3,459 (15·3 %)	3,660 (16·2 %)	22,592
„ 9, „	13,835 (63·9 %)	3,546 (16·3 %)	4,275 (19·7 %)	21,656
„ 16, „	11,772 (57·7 %)	3,608 (17·5 %)	5,186 (25·2 %)	20,566
„ 23, „	8,726 (45·66 %)	3,675 (18·5 %)	6,706 (35·84 %)	19,108
„ 30, „	6,145 (37·27 %)	3,168 (19·2 %)	7,173 (45·53 %)	16,486
Jan. 6, 1899	3,381 (24·7 %)	2,360 (16·27 %)	8,757 (59·63 %)	14,498
„ 13, „	2,635 (18·83 %)	1,905 (13·68 %)	9,454 (67·49 %)	13,994
„ 20, „	1,766 (13·13 %)	1,292 (9·6 %)	10,390 (77·27 %)	13,448
„ 27, „	1,135 (8·61 %)	1,071 (8·12 %)	10,977 (83·27 %)	13,183
Feb. 3, „	907 (7 %)	774 (6·5 %)	11,149 (86·5 %)	12,830
„ 10, „	723 (5·86 %)	709 (5·62 %)	10,994 (88·52 %)	12,426
„ 17, „	732 (5·97 %)	585 (4·77 %)	10,940 (89·26 %)	12,257

* Not printed with the Proceedings of the Commission.

STATEMENT from WEEKLY CENSUS of PLAGUE INCIDENCE among the UNINOCULATED, ONCE INOCULATED, and TWICE INOCULATED in GADAG TOWN.

	Uninoculated.		Once Inoculated.		Twice Inoculated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Previously reported	4	4	0	0	0	0	4	4
Week ending—								
Oct. 14, 1898	1	1	0	0	0	0	1	1
„ 21, „	3	0	0	0	0	0	3	0
„ 28, „	4	3	0	0	0	0	4	3
Nov. 4, „	3	1	0	0	0	0	3	1
„ 11, „	7	2	0	0	0	0	7	2
„ 18, „	7	5	0	0	0	0	7	5
„ 25, „	11	9	0	0	0	0	11	9
Dec. 2, „	14 (87·5 %)	13 (92·85 %)	2 (12·5 %)	1 (7·14 %)	0	0	16	14
„ 9, „	14 (93·37 %)	7 (87·5 %)	1 (6·6 %)	1 (12·5 %)	0	0	15	8
„ 16, „	28 (87·5 %)	14 (73·3 %)	3 (9·37 %)	1 (6·6 %)	1 (3·13 %)	0	32	15
„ 23, „	22 (84·6 %)	15 (83·3 %)	2 (7·69 %)	1 (5·5 %)	2 (7·69 %)	2 (11 %)	26	18
„ 30, „	36 (72 %)	27 (79·4 %)	6 (12 %)	3 (8·82 %)	8 (16 %)	4 (11·76 %)	50	34
Jan. 6, 1899	40 (71·42 %)	35 (85·38 %)	3 (5·36 %)	1 (2·44 %)	13 (23·22 %)	5 (12·2 %)	56	41
„ 13, „	28 (66·6 %)	23 (96·6 %)	4 (9·52 %)	2 (6·6 %)	1 (23·8 %)	5 (16·6 %)	42	30
„ 20, „	9 (39·13 %)	10 (58·8 %)	3 (13 %)	2 (11·7 %)	11 (43·47 %)	5 (39·4 %)	23	17
„ 27, „	14 (51·99 %)	13 (68·4 %)	3 (11·1 %)	2 (10·52 %)	10 (37 %)	4 (21 %)	27	19
Feb. 3, „	12 (38·7 %)	8 (44·4 %)	1 (3·22 %)	0	18 (58 %)	7 (46·6 %)	31	15
„ 10, „	9 (29 %)	8 (53·3 %)	0	0	22 (70·97 %)	7 (46·6 %)	31	15
„ 17, „	3 (12 %)	6 (42·85 %)	1 (4 %)	0	21 (84 %)	8 (57·14 %)	25	14

23,832. Was a census taken of Gadag, or have you taken the assumed population from the census of 1891?—A special census was taken in November or December 1897.

23,833. Who took the census, a European or a native?—It was taken under the direct supervision of Mr. Vincent, who was in close personal touch with almost all the people in the town. He threw himself very heartily into the work. He was the Chief Plague Superintendent, and he superintended the whole of the census; he did not go round to the different houses, but he did really know the people in Gadag and Betigeri.

23,834. The population was found to be 25,069?—Yes.

23,835. Subsequently the weekly population recorded in this statement declines week by week; can you tell us how it has been calculated?—Yes. Every Saturday morning the Superintendents of the districts went round. They kept the books of the number of people in each house, and they went to each house and saw how many of those people were present in the town at that time, and examined their inoculation checks, or passes, and only those were put down as doubly inoculated who showed a double inoculation certificate; and only those were put down as singly inoculated who showed a single inoculation check. That they did look at these certificates is indirectly proved in this way, that after the weekly census was taken people came up to have any slight errors in their certificates, which they themselves had not noticed, rectified. There is always a difficulty in getting a native woman to mention her husband's name. That is a very great difficulty in registration, that the wrong husband's name is registered. Each week these mistakes would be discovered by the Supervisor in going round, and the people would come up to me in the afternoon to get those errors rectified. The division into those three classes is based only upon that fact. I have never worked out any results upon the register as a whole, but on the actual numbers that were stated in this weekly census to be present in the town.

23,836. Previously by the native Superintendents?—Yes, and submitted to the Plague Superintendent.

23,837. With regard to the deaths among the uninoculated, and the once and twice inoculated, who decided in each instance the class in which the deceased person should be recorded?—The doctor in charge of the hospital, Dr. Foy. And I, myself, went to see all these cases in hospital. I went every day to look at all the cases that came in, and cross-questioned them as to whether they had been inoculated or not inoculated.

23,838. Whom did you cross-examine?—The patients, and the attendants who came with them.

23,839. They had one attendant as a rule?—Yes. Then if one could not get the information, one would go to the Supervisors of the district, and find out from them how they were entered in the book. The Supervisors get to know the people pretty well, because they go round every week and examine the checks and certificates in this way.

23,840. Were the people's addresses, as well as their names, entered in your register?—Yes.

23,841. And you have no doubt the registers are accurately prepared?—I am sure, every now and then, a slight error did come in. We had the errors of the husbands' names, for instance.

23,842. Who supervised the clerk who made the record?—I watched him the whole time myself; he was my clerk.

23,843. You were doing a lot of inoculation at the time, was it not rather difficult to combine those two duties?—Yes; it rather tired me when I did it. I had a man standing at one door to see that nobody went out without being registered. I stood at one table, and had a clerk by me who gave what I call my inoculation check to the persons inoculated. He took the fee and gave the check, which had the serial number on it. The patient who had just been inoculated walked up to the other table which was near to me, where the registering clerk sat, and his name was registered, and the name and the date written on the check. If a person did not come up with the right number he was at once stopped, because the clerk had missed one number out. I kept well on the alert, and was looking at the book every few minutes to see if he was ticking the people off in the order in which they came.

Miss A. M. Cornhorn, M.B.

8 March 1899.

23,844. Was the same care taken in registering people who were inoculated at Dharwar?—Yes.

23,845. Were you present when Capt. Leumann made his inoculations?—He did no inoculations there. At Dharwar I took exactly the same precautions; it was at Dharwar that I instituted that system.

23,846. Did you have the same system from the beginning of your work at Dharwar?—Yes, exactly.

23,847. You did a certain number of inoculations at Hubli?—Yes.

23,848. Were the Hubli registers as accurate as those at Gadag?—I had nothing to do with the registers at Hubli, but I do not think they were done so well. It was because of those shortcomings that I adopted my procedure at Dharwar.

23,849. Did you observe the inoculations carried out at Hubli by other persons?—Yes.

23,850. Did you observe Capt. Leumann actually inoculating?—Yes, I helped him.

23,851. How many persons were inoculated in the course of a day?—I could not tell you. I believe he did 700 in one day at Hubli.

23,852. At the time he was inoculating at that rate, were the registers accurately kept?—I could not tell you; I was not with him when he did those inoculations. I thought his system did allow room for some mistakes occurring, and that is why I adopted my system. I adopted some of his methods, but by always keeping the number of the person inoculated in my own hands, I think I sufficiently kept the person in touch with the certificate. A person who was inoculated twice got his certificate at the end. When he came up to me for the second time for inoculation, he presented his inoculation check, and the clerk who was by me asked him his name; he did not read out the name on the check, but the person had to give his name, and if the name did not correspond with the name on the ticket he was told he had brought the wrong ticket, and was sent back to get his own ticket.

23,853. (*Mr. Cumine.*) Why was the census taken in November or December 1897?—Because plague was expected.

23,854. Who is it that goes round every Saturday with the census book in his hand to inspect the people?—The supervisors and their clerks.

23,855. Do you mean a supervisor goes with a clerk, or do they go independently?—No; one clerk goes with each supervisor.

23,856. How many supervisors are there?—I cannot tell you; I have not done that part of the work at present. I forget the exact number of wards into which the town is divided. It is divided into six sub-divisions, but I am not sure what the number of wards is. I think each sub-division contains something like five or six wards, which would make about 24 wards altogether.

23,857. Would there be 24 supervisors, probably?—Yes, each supervisor has an average of 150 houses.

23,858. Assuming there are 25 supervisors, and a population of 25,000 people, each supervisor would have to see 1,000 people each Saturday?—That would have been so at the early part. Since a weekly census has been taken, we have never had 23,000 people there; it was 20,000, and on November the 18th, the first time the sub-division was made into three classes, it has been rapidly declining until now it is only 12,000.

23,859. Did any European officer test the work done by these supervisors on Saturday?—Yes. Mr. Vincent himself had to go round one week to one ward, and another week to another ward. He was generally out in that part of the town in which they were taking the census.

23,860. Do you mean taking the original census?—No, the weekly census. I do not say he went down with each one in particular, but he was generally supervising and seeing that the work was done correctly; they were done under his personal supervision the whole time.

23,861. Do you know whether he was testing it in the sense of taking the census register in his hand and making the people stand up in front of him?—I never saw Mr. Vincent do that, but I am quite sure, from what I know of his work, that he would have done it at several houses. He would not go to every house and do it, but that would be his way of testing it. He would go into certain houses and call the people out, and see whether the work had been done correctly in that house.

23,862. That is what you think he would have done?—Yes.

23,863. With regard to those people who died in hospital, you said that Dr. Foy was the authority to determine whether they should be registered as inoculated or uninoculated. Who was the authority that decided this with regard to the people who died in the town without going to hospital?—Dr. Foy, if he was called in; otherwise, the Hospital Assistant, whose work it was to see those cases. He saw the cases and sent in the returns, and when he was in any difficulty he referred to Dr. Foy as the Chief Medical Officer there. It was not a very difficult question to decide, because it was a question of getting a certificate from them. They were not to allow any uninoculated person to pass, because the information was not only wanted for my returns, but to decide whether the people were to go into contact camp or not. Directly a case occurred, there was an overhauling of the certificates by the officer who found the case, in order to decide which of the people were to be sent to the contact camp, because the doubly-inoculated people were not sent to contact camp.

23,864. Were the once-inoculated people sent to contact camp?—Yes, but the people were very anxious to bring up their certificates, and, therefore, no case would be likely to be missed.

23,865. I see that it was to the advantage of the twice-inoculated people to produce their certificates. But if the once-inoculated people were sent to a contact camp, what motive was there for them to produce theirs?—They do not hide certificates. Imitation has so very much to do with determining what a human being will do. When some brought out their double certificates, the others brought out their single certificates. The whole of the certificates are kept together, whether single or double, and the head of the house, when questioned by the supervisor, brings you out a roll of certificates—single and double certificates together.

23,866. How is this within your knowledge?—Because they are brought to me again and again. I have been into the houses to ask the people whether they are inoculated, and they produce these rolls of certificates in the way I have mentioned. If you go round to any town where great stress is laid on inoculation, you will find that is what they do. These people keep their certificates rolled up or mounted on bits of cardboard, and they are all tied up in a handkerchief, and the head of the family keeps them.

23,867. Have you been in the house of a once-inoculated person, after he had died, and seen the way in which the certificates are kept?—Yes.

23,868. Have you been in many?—Not many, because it was not my work; but I know the habits of the people. It is their habit to keep their certificates in that way.

23,869. I do not think you told us what the motive was for the friends of a deceased once-inoculated person to produce his certificate on the day of his death. What advantage is it to them?—One thing is this. They say, "you compel us to be inoculated, and here " is an inoculated person who has died."

23,870. What advantage is it to them?—There is no advantage, *but it is a human propensity. They think* that you have told them that a certain result will not follow a certain course, and when the result happens they bring you the evidence to show how it has happened. I think that is a very natural human motive.

23,871. Have people not to pay a fee for getting themselves inoculated?—Yes.

23,872. Therefore is there not a motive on the part of the brother of a deceased once-inoculated man to retain the deceased's certificate in order that he (the brother) may not have to pay a fee for getting himself inoculated?—Yes, but that is where the system of registration picks those people out. These people find every time they bring up a wrong ticket that they are sent back, and they find it is no use bringing up

another person's certificate. That is what Captain Brownrigg, who has lately been appointed our Chief Plague Superintendent, has remarked. He said that in Hubli he did find people presenting other people's certificates, but never in Gadag. Where you have a system of registration, the people are being continually reminded that they cannot cheat, or that if they do they will be found out. When their certificate is presented they are asked their name. They do not know the name on the certificate because very few of them can read, and they give their own name.

23,873. If A's brother has been inoculated, the name of A's brother will be on the certificate. Does not A know his own brother's name?—Yes, but he has to report his brother's name as the person who has died. The name of every member of the family is down in the supervisor's book. Therefore as A would have to give the name of his brother, who had died, as being inoculated, he cannot choose that name for himself.

Miss A. M. Corthorn, M.B.

3 March 1899.

23,874. Will you tell us whether your register of inoculated persons is in Mahratti or in English?—It is in English.

(Witness withdrew.)

(Adjourned till Monday, 6th March, at Sholapur.)

At The Railway Station, Sholapur.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

SIXTY-FIRST DAY.

Monday, 6th March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

MR. J. P. HEWETT. | MR. A. CUMINE.

MR. C. J. HALLIFAX (*Secretary*).

Mr. W. M. MUAT, M.B., called and examined.

Mr. W. M. Muat, M.B.

6 March 1899.

23,875. (*The President.*) You are a Bachelor of Medicine?—Yes, and Master of Surgery, Glasgow.

23,876. You are in an official position here?—Yes, temporarily on plague duty; special work.

23,877. You have been inspecting health camps?—Yes.

23,878. And also supervising contacts?—Yes.

23,879. Since the re-occupation of the city of Sholapur in April 1898 you have had some experience as regards the inspection of corpses, I think?—I have all the time up to the present; it is still going on.

23,880. Have you encountered any difficulties?—I do not think I have ever really; perhaps once or twice they may have said some slight thing, but I have had no serious difficulty at all.

23,881. To what extent do you inspect corpses?—Every corpse; every person who dies in the city.

23,882. Male and female corpses?—Yes, Muhammadans and Hindus alike.

23,883. Are there no pardah nashin women here?—I have not had any trouble at all. I have seen every corpse that has died for quite a year, I should think, in the city.

23,884. And no objection was raised at all?—No serious objection. There was only one case, and it was not a serious objection at all. They simply said that they wanted a female doctor.

23,885. What does your examination of the corpse consist of?—I examine the eyes and tongue, the situation of the lymphatic glands and the general appearance of the face.

23,886. You examine the groins, for example?—Yes, the groins and the axillæ.

23,887. Have you been here all the time of plague at Sholapur?—I came here in the first or second week of December 1897.

23,888. When did plague commence in Sholapur?—I came here just at the height of the epidemic. The epidemic started on the 23rd of September 1897.

23,889. Did you find when you came that the measures to eradicate the plague were already in operation?—Yes, they were.

23,890. What were the measures?—The removal of plague cases to the Plague Hospital and the segregation of the families in which the cases had occurred; then there was evacuation of the city; and then, after the city was evacuated, the houses were all disinfected with chemicals, and thrown open, holes were made in the roofs and walls, and all filth was removed from the houses and streets, and alleys and courts, and burnt. The city had a thorough clean up, I should say.

23,891. Were all these measures adopted simultaneously?—Of course the disinfection took place when the city was evacuated.

23,892. But the other measures?—The first three measures were concurrent, and then the disinfection and the burning of dirty rags took place. The city was evacuated, and the filth removed.

23,893. I understand first that the evacuation was only in parts?—Yes, it was at first only partial. The epidemic started in a small suburb of the city, the Sadr Bazar, just about a mile and a half from the city. It is situated between the European quarter and the city. The plague started in the European quarter, amongst the servants of the Europeans who were living in camp. Then it was carried by the servants, I presume, down to the small Sadr Bazar. One man was found suffering from plague in a temple in the Sadr Bazar, one of the original household that was attacked. He was found in the temple sick of plague.

23,894. At first you evacuated that part in which cases occurred only?—That was evacuated first. The city was commenced to be evacuated in October 1897, and it was completely evacuated by the end of December 1897.

23,895. Before any evacuation took place, was there any segregating of the affected and their contacts at the very commencement?—I do not know really, as I was not here when it started.

23,896. When you were here evacuation was proceeding, in the first place, in affected areas?—The original infected area had been evacuated when I came here.

23,897. Had any subsequently infected area been evacuated?—When I came here they were just commencing to evacuate the real city.

Mr. W. M. Muat. M.B.

6 March 1899.

23,898. Do you know why they did not content themselves in evacuating a limited area?—The plague had commenced in the real city, in Sholapur.

23,899. When plague appeared in the true city, they started to evacuate the whole city?—Yes.

23,900. And that took from October until when?—Until the end of December, from the 26th of October till the 31st of December.

23,901. That is rather slow progress, is it not?—It is a rather large city, 63,000 people, to make arrangements for people going out into camp; you cannot do it all in a week.

23,902. You had 60,000 people to deal with, had you?—No, I should say about half the population, 30,000 or so.

23,903. And to evacuate 30,000 people, you think you would require about two months?—I should think so, quite. You did not know that the houses that the people fled from were evacuated or not; and you had to classify all the houses in order to find out whether they had really left. You had to go over the whole city to see whether they had left or not, so that you were dealing with a larger population than 30,000.

23,904. What became of the people who had disappeared?—They had gone into the villages and the surrounding places at once.

23,905. At what stage of the epidemic was the great voluntary exodus, or flight, as it were?—I could not say it was, but I suppose it was about a month.

23,906. Before you came, or after?—It was still going on when I came; the bulk had gone out.

23,907. The bulk had gone out before you came?—Yes.

23,908. I suppose you did not know where they went to?—They went to the surrounding villages and fields, and they disappeared. They could not go out by train, for instance. Tickets were refused, without a special pass.

23,909. You do not know when the voluntary evacuation really commenced?—No, I could not say definitely; it had commenced before I came.

23,910. Why did the people run away?—I thought it was simply on account of the fear of segregation, and of going to the Plague Hospital, and also the disinfection of their houses, and that sort of thing. It was not so much the fear of the disease, I think, from what I have seen.

23,911. You think the exodus did not occur till after segregation had been put into operation?—The people knew all that took place in Bombay, and other cities. They knew that they would be segregated, and their houses disinfected, and that they would be put to all that trouble in that way. They knew, of course, what was going on.

23,912. Have you any knowledge as to whether by this flight, plague was imported into any of the neighbouring villages?—Yes, distinctly.

23,913. Cases did not come within your personal knowledge, but you know of them?—I have had nothing to do with the villages, but I have heard that that did take place.

23,914. How many people did you get into the health camps?—I did not know the population of the health camps at that time.

23,915. Have you any idea; was it 5,000, or 20,000?—There were three main camps, and it is rather difficult to say.

23,916. Were the evacuated people allowed to return to the town on any conditions?—The city was completely evacuated at the end of December, and in March, special well-known people were allowed to go back, people who had been known to have been living in the fields, or in the camp, healthy people.

23,917. Not before?—No, not till March 1898, I think.

23,918. In the meantime they were not allowed to go to the city at all?—They were not supposed to, of course.

23,919. They may have gone contrary to regulations?—Yes, they may have gone contrary to orders, but I do not know.

23,920. Not merely to follow their occupations during the day?—They were working at their occupations outside in the camp, the weavers, and others.

23,921. You managed to transfer the weaving and other apparatus?—Yes, we transferred it.

23,922. And all the ordinary handicrafts were carried on outside, in the camps?—Yes; I have seen them making wheels, and also blacksmiths working there.

23,923. After this evacuation, how did you disinfect the houses; what did you do?—They had special pumps to scatter disinfectants all through the houses, to wash the houses and sprinkle them thoroughly with disinfectants. All rags and dirty clothes were taken out. Anything of value was disinfected, but the other things were burnt.

23,924. You disinfected with chemical disinfectants?—Yes. Of course in the case of the lower houses, the poorer houses, the roofs were taken off; that is in single storey houses.

23,925. You let in light and air as far as you could?—Yes.

23,926. What did you do with regard to the better houses?—They were treated with chemicals, and after that they were limewashed. The better houses were only disinfected with chemicals.

23,927. Had they a sufficient number of ventilating apertures?—Yes; they were respectable houses with good windows, and so on.

23,928. Do you know whether this evacuation did any good, as far as the extinction of the plague among the evacuated was concerned?—Yes, I should think so, most distinctly.

23,929. On what grounds do you think so?—The moment the city was evacuated, plague disappeared.

23,930. In the camps?—It disappeared altogether, if you refer to the statistics.

23,931. I think you said the evacuation was completed in December?—Yes.

23,932. Could you tell us, generally, how many cases had occurred before this evacuation was completed?—The following list shows the weekly number of attacks and deaths in Sholapur City:—

Week ending		Cases.	Deaths.
1st October	1897	13	9
8th "	"	6	4
15th "	"	26	8
22nd "	"	50	45
29th "	"	116	90
5th November	"	146	117
12th "	"	143	118
19th "	"	221	182
26th "	"	363	297
3rd December	"	502	377
10th	"	501	436
17th	"	300	246
24th "	"	134	149
31st "	"	53	36
7th January	1898	26	27
14th "	"	9	9
21st "	"	7	11
28th "	"	5	8
4th February	"	1	2
11th "	"	—	7
18th "	"	1	4
25th "	"	5	3
4th March	"	—	2

23,933. The number of cases in the town, then, immediately became greatly reduced in a very striking way after the evacuation was completed at the end of December?—Yes, it was a very striking fact.

23,934. Do you know how many cases occurred in the segregation camp?—Yes, I can give you the number if you care to have them.

23,935. Can you give them, week by week, or every 10 days, as they occurred?—There were several segregation camps. The first segregation camp was formed in the fields round the Plague Hospital. There was a special Plague Hospital built. There were 1,421 contacts admitted into this camp. Out of that number there were 101 cases of people who developed plague. 1,320 people were discharged.

23,936. Can you give me the numbers in the evacuation camps?—These are the health camps. I could not tell the number of inhabitants in the health camps.

23,937. Can you tell me the number of cases that occurred among the people who were evacuated from the city?—No, I could not give you that.

23,938. Have you not got any statistics?—No.

23,939. Have you no means of finding out how many people got plague, under your own observation? Were they not reported?—Yes, they might be worked out.

23,940. Can you evolve that information from this table?—That is how the cases occurred. The dates of the plague cases and deaths that occurred among the evacuated population are as follows:—

Week ending	Cases.	Deaths.
7th January 1898	10	9
14th " "	9	9
21st " "	7	11
28th " "	5	8
4th February "	1	2
11th " "	0	7
18th " "	1	4
25th " "	4	2
4th March "	0	4
Totals	37	56

23,941. The impression is that the evacuation had very quickly reduced the number of cases?—In my opinion that is so.

23,942. The figures bear that out?—Yes; and, from what I saw, I should think that is so.

23,943. When you allowed the people to return to the town, did you have any recrudescence, as it were, of plague?—No, none whatever.

23,944. Has it remained free from plague since their return?—Yes, it has.

23,945. There have been no further cases up to the present?—There have been a few scattered imported cases through the town occasionally since.

23,946. By what means did you prevent these imported cases from starting a new epidemic?—The contacts of these cases were immediately segregated, and the house was treated in the former way. The house was evacuated, and re-disinfected, and left unoccupied for a certain time.

23,947. Everyone was removed from that house?—Yes; and then the house was disinfected, and left unoccupied for about a month or six weeks.

23,948. How would you explain the success with which you have now prevented an importation of plague into this large city, from lighting up an epidemic, as contrasted with the failure of your measures when the plague originally occurred? What is the difference in your methods now, and how do you explain why you have succeeded now when you did not succeed before?—The city is in a different condition to what it was then; it is very much cleaner, for instance.

23,949. Anything further?—Probably the very susceptible people have taken plague and died; and the cases have been immediately detected, and steps taken.

23,950. Is not that probably alone enough, that you are able to get sufficiently early information now, where you could not get it previously? Is not that the material point in your success now?—It might be half the point. I consider that it is principally because most of the susceptible persons have been removed.

23,951. And what are the other points?—The city is cleaner, and the people are not so susceptible; having gone through an epidemic, the susceptible people have been removed, and have had plague, and all that.

23,952. What is the chief provision in making segregation useful for preventing an epidemic when plague is imported into a town?—My opinion is that we must catch the first one or two cases.

23,953. Have you any knowledge as to rats having been instrumental in propagating plague?—No; I have not. On two occasions since the epidemic I have been asked to go and see dead rats. The people get very excited, of course, and I went and saw the rats. The first case I went down to see was that of a young rat and a mouse, lying together. That created a great scare, but I took it that cats had caught these two and killed them. However, the people were very excited. Since then I have seen two dead rats in a house, but there was nothing further. The house was disinfected, and so on.

23,954. There have been no great number of deaths among rats in this epidemic to your knowledge?—No; not to my knowledge.

23,955. How do you think the plague is extended from one person to another?—I think by contact—dirty infected clothes. That is all I have had experience of.

23,956. Have you had any instances of clothes having conveyed infection?—Yes.

23,957. Will you detail any of those instances?—I could not give a specific instance, but I know of several cases where clothes had been stolen from the Plague Hospital by temporary attendants, had been concealed, and cases occurred from those clothes. I thought they had occurred from those clothes.

23,958. The people who obtained these clothes suffered from plague?—Yes; they took plague.

23,959. What was the general characteristic of the houses in which most cases of plague occurred? Were they the best houses, or the worst?—Cases occurred amongst the better and the poorer classes equally, in my opinion.

23,960. In what kind of houses did the better classes live? Can you give any description of the kind of house?—They are very good houses of course. In comparison the houses in which the better class people live here are really very good houses, I should say.

23,961. And the poorer class houses?—They are generally four mud walls, with a roof of thatch, or sometimes tiles.

23,962. An equal number you think occurred among the rich and the poor?—Yes.

23,963. You have no experience of plague in the outvillages?—No: none at all.

23,964. (*Mr. Hewett.*) I understand you to mean that the possession of a good house did not secure a person against immunity from plague?—No.

23,965. The disease broke out first of all in the servants' quarters of the Europeans?—Yes.

23,966. It then went to the Sadr Bazar?—Yes.

23,967. How do the houses in the Sadr Bazar compare generally with the houses in the rest of the town?—There are also good houses there of course, but there are also dirty houses and huts.

23,968. Are they pretty good there, or are they below the average?—There are not so many rich people in the Sadr Bazar; they are mostly working people.

23,969. You say 1,500 cases were reported here in the five weeks ending December 31st. I suppose you cannot estimate what the number of the people in the town was during any one week of that period?—No, it would only be guess work.

23,970. But is it the case that after the end of November, the population of the town was rapidly diminishing?—Yes, distinctly so.

23,971. Do you think it is possible that the epidemic reached its height in the middle of December, and then went down of its own accord?—I do not know. I could not say that. I thought it was the evacuation that did it—the people coming out of the houses where the infection was.

23,972. When the 501 cases took place in the week ending 10th of December, was not a great portion of the town evacuated by that time?—Yes, I suppose about three-quarters of the houses had been inspected, and the people turned out.

23,973. When you examine a female corpse, do you examine the groin?—I do always.

23,974. There is no objection taken to your doing so?—No, not at all.

23,975. Can you tell us the number of imported cases that have taken place since the people have returned to their houses?—Ten. One in April 1898, one in June 1898, one in August 1898, one in September 1898, two in October 1898, three in November (two of them on the same day, and from the same place); and one in February 1899.

23,976. (*Mr. Cumine.*) You said I think that segregation of contacts is useful, if applied to the first two or three cases detected in a town?—Yes, I think so.

Mr. W. M. Muat, M.B.
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23,977. Does the following passage in your précis of evidence still represent your views on the subject of segregation:—"Segregation to be of any avail must "ensure that the first two or three cases are detected: "after that the means defeats its own end in that the "inhabitants immediately take fright. Notwithstanding "the means taken to prevent it, the inhabitants "of this city immediately fled to the surrounding "villages, carrying the infection with them. The small "number of plague cases occurring in the contacts "segregated, did not, I think, counter-balance this "evil."?—I am still of that opinion.

23,978. Did you notice that there was anything in the nature of the floors of a room that had any effect on the number of people attacked in that room? Were they stone floors, or wooden floors, or earthen floors, that were most liable to get infected with plague?—Most of the houses in the city have earth floors; a very great majority.

23,979. You did not notice that one kind of floor was more liable to give infection than another?—No. You see so many earth floors, that your attention would not be drawn to that.

23,980. (*The President.*) As you use both words, segregation and evacuation, might I ask you if you mean exactly the same by both words?—No.

23,981. Will you define what you mean by segregation?—By segregation I mean contacts being put in a special camp.

23,982. You mean the removal of the patients and the contacts only, not the surrounding inhabitants?—Yes.

23,983. By evacuation what do you mean?—General evacuation, the people leaving the city.

23,984. Of the whole city, or a large area?—Of a large area.

23,985. Therefore, while you think the segregation and the removal of the patients and of the contacts in the same house is useful, still you consider that it is only so where you have very early information of first cases?—Yes.

23,986. On the other hand, you think that evacuation is always useful?—Yes, always useful.

23,987. (*Mr. Hewett.*) Do I understand that you think that evacuation is useful to the place from which you remove the people? Do you think Sholapur town for instance would benefit by evacuation?—Yes.

23,988. But might not the places outside somewhat suffer from it?—It just depends on the way it is done, I take it.

23,989. You say that people ran away from the town carrying infection to the neighbouring villages. Do you think that the evacuation of the city led to that result?—It did, but that is not the compulsory evacuation by the authorities. That came about by the people running away themselves, in order to try and escape segregation.

23,990. In order to make the evacuation of a big town effective, is it not desirable that you should be able to get hold of all the people who leave the town, and keep them under observation?—Yes.

23,991. Is it possible?—No, not in a town of 63,000 inhabitants.

23,992. (*The President.*) In regard to this question of segregation, if you got early information of one or two imported cases, such as I understand you had originally, and if you segregate these people (the actual patients and the contacts) even although there were a panic, if they were the only cases, would there be any harm in other people running out of the town because of the panic?—No, I do not think so, if the people were apart from the commencement, and had no contact with the cases.

23,993. But I understood you to say that there would be no benefit unless you got information of imported cases and took away the patients and the contacts? You now get information of the imported cases, and are able to segregate them and the contacts?—We get all information up to now, I should say.

23,994. You do that without panic now?—Yes.

23,995. There has been no exodus?—Not because of these specific cases.

23,996. How do you account for that?—I suppose the people are not so much afraid now, and the measures are not so very irritating to them.

23,997. What measures?—Segregation and evacuation and disinfection.

23,998. Have you made any variation or change in the measures?—No.

23,999. The measures remain the same?—Yes.

24,000. But the people are not so frightened of them now?—No.

24,001. As they become accustomed to them, they learn what they mean?—Yes, they see the benefit of it to themselves.

24,002. (*Mr. Hewett.*) Supposing that you had an outbreak again in this town, do you think that the people would run away?—I do not think they would, unless it became very bad. If it did, I suppose they would.

24,003. They did not run away when the epidemic first broke out?—No, but when it started in the Sadr Bazar, the people in the main city took fright and ran away.

24,004. Have you noticed that the Mangs in this town have remained relatively free from plague?—Yes, I could take you to a little patch on the borders of the town which was not evacuated. There were very few cases, and the people lived there all the time.

24,005. Why were they permitted to live there?—Because they would have fled, and gone out, and struck work.

24,006. Were they not used to work within the town?—Yes.

24,007. That was the object of keeping them there?—Yes, that was the object of keeping them there.

24,008. Do you attribute their comparative immunity to the fact that they did not mix much socially with the other members of the town?—I am not prepared to answer the question. I mentioned the fact of the few cases that occurred in the unevacuated Mangawada, to show that plague cases were not more frequent amongst the poor and dirty classes than amongst the rich and better classes.

(Witness withdrew.)

Lieut. M. E. L. Bruce, I.S.C.

Lieut. M. E. L. Bruce, I.S.C., called and examined.

24,009. (*The President.*) I believe you are in the Staff Corps?—Yes.

24,010. And you have been on special work at Sholapur?—Yes.

24,011. Since what time?—15th November 1897.

24,012. (*Mr. Hewett.*) At that time how many villages were affected in the Sholapur district?—I was working in the city from the 15th of November to the 26th of December. That was the date it was turned out. There were about three villages which were known to be infected during that time.

24,013. You were employed in the city up to the end of December?—Up to the 26th December, and then the village inspection was done by me to find out how many villages were infected. I went out on 26th January. We then knew of only about three or four villages, but by the 4th of February we knew of 50.

24,014. I should like to ask you one question about the town first; can you give an estimate as to the number of persons there were in the town in the week ending 10th December, when there were 501 cases of indigenous plague?—I cannot give you the exact figures, but I should think there would be from 25,000 to 30,000 people in the town.

24,015. By the beginning of February you found 50 villages infected?—Yes.

24,016. Were you able to trace the infection in the case of many of these villages?—The infection could be traced in almost all with very little trouble. I found out that people had come from Sholapur and were living in the fields and some in houses.

24,017. Since February 1898, when there were 50 villages infected, what was the maximum number of villages you had infected at one time?—There were 50 villages infected at that time all round Sholapur, and there were three or four villages in the Madha taluka.

24,018. Have you had more than 50 villages infected at one time?—No.

24,019. At the present time how many villages are infected?—At the present time there are about seven villages infected, though they are not certain whether it has not stopped.

24,020. Otherwise you have no plague in the district?—In two villages we have got plague, I have got reports coming in every day.

24,021. You have two villages with plague and seven which are suspected?—Seven are under inspection.

24,022. During the time when plague was at its worst what was the maximum number of European officers employed in the villages?—There were three European officers.

24,023. I suppose some of these villages are at considerable distances from one another?—The place was divided into wards. The furthermost villages are about 15 or 17 miles from here.

24,024. During that time what was the maximum number of villages under your personal control?—Fifty villages and ten infected villages, I think.

24,025. Did you find it possible to visit each of these villages once a day?—No.

24,026. How often could you visit them?—I did not go in for visiting villages a great number of times. I camped at one village, and did the whole of the work in that village, and stopped plague in it if possible at once, and then went on to the next.

24,027. The people remained in the fields after the village had been evacuated?—Yes, the people remained in the fields.

24,028. And you stayed there until plague was practically got under?—No; I did the work necessary to stop plague in the course of two or three days; I then went on to another village and worked at that for two or three days.

24,029. You did not stay in these villages to see if the people obeyed instructions with regard to their not going back to their houses?—No.

24,030. Do you think that more European officers than were employed in Sholapur are required to carry out work in the villages effectively?—Yes, most distinctly more were required. I was entirely alone in the work. I had a Plague Officer under me, and I had a certain number of sepoys who helped me.

24,031. Were you employed in the villages during the monsoon?—I was out all through the rains, from July to the present time, practically

24,032. Do you think that making the people evacuate a village site during the rains causes hardship, or not?—I think it causes them a certain amount of discomfort, but it is quite worth it. The people do not object to it, to anything like the extent one would suppose.

24,033. You think that during the rains in the black cotton soil and in the exposure to which they are subjected, the people are not made more liable to other disease by being evacuated at that time?—I noticed absolutely no amount of higher mortality from other diseases. The people were wonderfully well considering everything.

24,034. When you have got the people segregated in their own fields, and a case of plague occurs among them, what measures do you take?—I make them commence in the early morning, and pull down the original hut in which the case occurs. Next I make them put up a small hut for the sick man, a three-cornered hut so that nobody else can get into it. I send them off to have their clothes washed, and late in the evening when they have done that they build a new hut for themselves. I make them keep out as many things as possible, only allowing them to take in their cooking materials and the clothes they actually require.

24,035. Who does that if you do not happen to be in the particular village in which the case has occurred?—The village officers have instructions in writing and they are told to carry them out. As a rule I think they do the work fairly well.

24,036. Do you use any disinfectants in the villages now?—No.

24,037. Why not?—Because as far as the houses are concerned we have several cases of villages which have shown that it does not appear to be necessary; they have been re-occupied without any further recrudescence. With regard to clothes and other things, washing and sunning them have proved quite sufficient.

24,038. In the case of these villages which have been re-occupied without disinfection, how long did you keep the people out?—In some cases over three months.

24,039. What was the minimum time for which you kept them out?—Three months.

24,040. You think that after people have been kept out of a village site for three months, it is practically safe to let them back again without taking any measures to disinfect beyond improving ventilation and allowing sunlight to enter?—Ventilation and emptying the houses.

24,041. Do you think that plague is taken from village to village mainly by human agency or any other way?—Mainly by human agency.

24,042. How do you think it is carried about in a village?—By rats.

24,043. Have you noticed any instance in which rats brought plague from one village to another?—No.

24,044. In your experience what is the course of infection in a village?—First of all a case occurs in one house, and then I have always thought that rats take it to other houses. Of course, people communicate it themselves.

24,045. Do you think that the importation of the disease from outside is in the majority of cases followed by mortality among rats before the residents of the place get infected?—I think it is.

24,046. Have you any instances of villages in which there has been no mortality among rats?—No. It may have occurred, but I do not know of it. It has not been observed.

24,047. Have you had any village in which no mortality has been reported to you amongst rats?—No.

24,048. That is to say you have had rats dying in every village?—Yes.

24,049. Have you noticed that any other animals are subject to plague?—No.

24,050. Have you had any instance in which plague has been imported from one village to another simply by means of clothing without any person having come from an infected to an uninfected area?—No, I have no experience of that.

24,051. Have you noticed that the Mahars and other outcast people have escaped infection when a village has been infected?—Very frequently, even though not evacuated.

24,052. In how many villages have you noticed this?—In four or five, I should think.

24,053. Would you infer from that that the reason for their escape is that they do not mix with other people?—That, and the fact that they do not keep corn in their houses which might attract vermin.

24,054. (*The President.*) What sort of lives do these Mahars lead?—They are always working. They are practically village servants. Of course, they are very poor. Some of them in the big villages own a certain amount, but as a rule they own nothing. They are fed by the village.

24,055. Their life is a very out-of-door one, is it?—Yes, very.

24,056. More so than the other members of the community?—Much more.

24,057. That is the great characteristic?—Yes.

24,058. Have you got any example of an evacuated village in the rainy season where the people seemed to be not much discomforted by being out?—Three villages were out through very rainy weather. I was out with them all through the time, visiting them, and going round to see what their complaints were. Of course, they were put to some discomfort undoubtedly, but they managed all right, and their complaints were

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very few. They certainly preferred to be out to living in the village.

24,059. How did they show their preference?—I had one case where they tried to raise an objection, I offered to let them go back to the village, but they refused.

24,060. Have you any examples of the speedy termination of an epidemic in a village by the complete evacuation of that village?—Yes.

24,061. Could you give us a few examples briefly?—Plague commenced in Korali village in the Sholapur taluka about the 21st of March last, and I got news of it on the 27th. Six families were infected then. The village was vacated on the 29th of March, and plague ceased on the 2nd of April. In all nine families were infected.

24,062. Can you distinguish between before and after?—Yes. There was only six families attacked on the 27th. Between that and the 2nd of April three more families were attacked.

24,063. What is the normal population of this village?—About 800.

24,064. Have you other examples of a similar description?—Nothing so good. Patri village was a rather worse example, because plague only showed itself in the form of buboes in one family; we had about four cases of fever immediately afterwards, and about two deaths, and then it stopped. I do not think it is a sufficiently good case.

24,065. Do you know which of the villages evacuated had the largest population?—Mole village, with about 4,500 inhabitants.

24,066. Is that the maximum?—Yes.

24,067. Do you think it is quite convenient to evacuate a village of that size?—No, I think it caused plague to spread to about 10 other villages.

24,068. Because of what?—Because the people simply ran away, and there was nothing to stop them.

24,069. You had no cordon?—No.

24,070. You could not well manage so large a village?—I could not manage it at all; it was quite impossible. I was by myself.

24,071. (*Mr. Hewett.*) When you say you could not manage it yourself, I suppose you mean that the people were determined not to stay in the fields?—The people had lands in other villages. Naturally there was a great number of well-to-do people in such a large population, and they simply went off to other villages. If the other villages could have been depended upon to keep them out, it would have been all right; also, had we been able to make examples of them. In any case it is very difficult.

24,072. Would you draw a distinction between the smaller and the larger villages? In the smaller villages you mainly had agriculturists who are tied down to the village, and do not want to run away to other places?—Yes.

24,073. And, consequently, with a small agricultural community you would find it much easier to take the people out of the village site and keep them in the fields?—Much easier; they would be more inclined to obey in any case.

24,074. But your difficulties are increased when you meet with a population that is accustomed to travelling and has interests outside the village site?—Exactly.

(Witness withdrew.)

(Adjourned till Tuesday, 7th March, at Ahmednagar.)

At The City Magistrate's Office, Ahmednagar.

SIXTY-SECOND DAY.

Tuesday, 7th March, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT. | Mr. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. C. Hudson, I.C.S.

7 March 1899.

Mr. C. HUDSON, I.C.S., called and examined.

24,075. (*The President.*) You are the Collector here?—Yes.

24,076. And you have had considerable plague experience in Ahmednagar?—Yes.

24,077. (*Mr. Cumine.*) When did you come to Ahmednagar?—In the end of December, 1897, practically the 1st of January, 1898.

24,078. When did the plague begin in the Ahmednagar district?—I cannot tell you that off-hand, but about the end of October.

24,079. What was the first place affected, do you remember?—I do not know that. Captain Walton will be able to tell you that.

24,080. Before you came to Ahmednagar had you had experience of plague in any other district?—Yes; in the Thana district, Salsette taluka.

24,081. For how long?—From February, 1897, to December, 1897.

24,082. Have you noticed whether infection amongst rats always intervenes between the infecting imported case, and the first local case?—No; I have not always noticed that.

24,083. Do you know of any instance where clothes have certainly carried infection?—Yes; I know an instance in this district, in Rajapur.

24,084. Can you, with certainty, exclude the possibility of human agency, the possibility that the person who brought, or went to fetch the clothes, was the agency that communicated the infection, and not the clothes?—In this case it was a Marwari family attacked, and the infection was given to the Mahars. There was no plague in the Maharwada. The Mahars got the plague, and I think it is almost certain that it was conveyed in that way.

24,085. It is certain that the Mahars got the clothes?—Yes; that is quite certain.

24,086. Is it certain that the clothes were from an infected person?—Yes.

24,087. Could you describe the circumstances to us?—No; I cannot say any more than that.

24,088. Is the case within your own knowledge, or has it been reported to you?—It has been reported fully from this district, in an official report to Government.

24,089. How is it, that, in your opinion, plague is carried from village to village, by what agency—human-

agency or rats, or what?—I think nearly always by human agency. In one case they said rats had done it, but it was only a little bit of village gossip, I think.

24,090. How do you think it is carried from house to house within the limits of a village?—I do not know. It does certainly seem to go from house to house, but in this city of Ahmednagar there were no deaths of rats observed like there were observed in Bandra. In Bandra I should say rats certainly did carry it about.

24,091. Did you see any rats going from one house to another?—No. (Note by witness on correcting proof of his evidence:—Since giving my evidence I have had two opportunities of observing the spread of infection; in the Maharwada of the city, and in a village called Sonevadi; in neither case could it be said to have spread from house to house as at Chichondi, where no dead rats were observed.)

24,092. Have you any experience of the kiln system of disinfection?—No; I should think it would be a very dangerous system to adopt generally, judging by experience in Savedi here, where there were three workmen engaged in digging up the floor of a room, and two of them got plague. Of course no precautions were observed, but still they got it.

24,093. Have you any instances where animals, other than rats, such as cats, pigs, and squirrels, certainly died of plague?—No.

24,094. Is there any instance within your knowledge where plague has recrudesced, that is to say, where a village which was infected has had a long interval of freedom, and plague has appeared in it again without a re-importation of infection from without?—No.

24,095. Have you any instance where a village has become infected this year, which was not infected last year, but which is next to a village that was infected last year?—Yes; in the town of Bassein itself, in the Thana district.

24,096. What happened there?—The plague began there in December, and it was supposed to have been stamped out in June.

24,097. I was asking you about a case where plague has appeared in a village this year which was not affected last year, but which was next to a village that was affected last year?—In the case of Savedi, Varanghusi, Chichondi Patel, and a village in the Khandesh district recently at Kanaswadi.

24,098. This last is not within your knowledge?—No.

24,099. What happened in those cases which are within your knowledge?—Savedi is next door to the city of Ahmednagar, and there was no plague there last year, and it broke out this year.

24,100. How long was the interval between the ceasing of plague in the Ahmednagar City and the appearance of it in Savedi?—About six months.

24,101. Have you noticed whether there was any heavy infant mortality in Savedi during those six months?—No, I have not noticed it. I do not think there was.

24,102. What is the next instance?—In Varanghusi a similar thing occurred. Pendshet, a small neighbouring village in the Ghauts, was infected last year, and, about six months after, Varanghusi became infected.

24,103. Have you been unable to trace any infection of Varanghusi this year from without?—When I wrote my précis of evidence it was suspected that it may have been imported from a village in the Thana District, and it is possible it was so imported. I am inclined to think myself it was so imported.

24,104. The third case?—In Chichondi Patel, 13 miles from here. There was plague in a village called Athvad previously, and Chichondi Patel got infected this year, and the source has not been traced.

24,105. About Chichondi Patel have careful inquiries been made to find out whether it did not come into it this year from without?—Yes, very careful inquiries have been made. I myself and others inquired on the spot, and we could only find out that the Chamars first got infected, but whether they were infected by Marwaris or not has not been found out; it is only known that the Chamar families first got plague.

24,106. Had any of them been away, or had any outsider come to them?—That has not been found out.

24,107. Have you examined the death-rate during the interval of six months to see whether it was suspicious?—Yes.

24,108. Was it suspicious?—No. That is how the 20th of October was fixed as the probable date of the outbreak; by examining the births and deaths register.

24,109. Then the outbreak had been going on for some time this year in Chichondi Patel before it was discovered?—Yes, from about the 20th of October till about the 30th of November or the 1st of December.

24,110. Have you noticed whether cases that come direct from Bombay into this district readily infect this district, or whether the cases that most readily infect this district are cases that have come from some half-way house, such as Lanauli?—No, I have not noticed that.

24,111. Is there any other interesting fact that you wish to tell us about?—Yes, with regard to inoculation.

24,112. What have you to say about that?—I remember reading Professor Gajjar's evidence, and he seemed to think that inoculation was prejudicial to the uninoculated; that it made them get plague in some way or other. My experience is quite opposed to that, because about half the camp was inoculated and half not, and nobody suffered in any way; none of the uninoculated got plague, or anything like that, from the inoculated.

24,113. At that time there was no plague in the camp?—I was camped near infected villages, but there was no plague actually in the camp.

24,114. (*The President.*) Have you encountered any cases in which plague has occurred among the inoculated?—Yes, I know of two cases, but I have not seen them.

24,115. Can you tell me if the type with regard to the virulence of plague has varied at any times of the epidemic?—No, I do not think so.

24,116. It has been the same throughout?—Yes.

24,117. Have there been any cases which have been so mild that the diagnosis was difficult?—Not that I personally know of. I know of mild cases escaping from camps, and getting let through without being discovered to be plague cases at all. I know of one instance of that kind where infection was carried by a mild case of that description.

24,118. The symptoms were so slightly pronounced that it was not recognised as a plague case?—Yes.

24,119. By whom would that recognition be made?—By a Hospital Assistant.

24,120. Have you had much experience of disinfection?—Yes.

24,121. What is your opinion as to the value of disinfection?—I think it is a very good thing for the workpeople who are engaged on the work.

24,122. Who are putting the houses in order, or what?—In the Deccan districts, where they have to open up mud roofs.

24,123. Do you mean that the houses should be disinfected before the workmen go in to do that?—Yes.

24,124. Do you include in that exposure to light and air, or merely chemical disinfection?—I think it would do, if the workmen had disinfectants to wash themselves with.

24,125. I am speaking rather of the habitations?—I am referring to the safety of it for opening up, simply. I think opening up the houses is the best thing of all.

24,126. You put that kind of disinfection first because it comes to be a disinfection before disinfection by chemical agencies. Is that the result of your experience?—Yes, but I could not give any explicit reasons.

24,127. That is the impression which is produced in your mind?—Yes.

24,128. How long do you consider, before a house became safe, that this non-chemical method of disinfection should be in operation in that house? Would it be a matter of a few days or weeks?—I think it would be weeks.

(Witness withdrew.)

Capt. W. C. Walton, I.S.C.

7 March 1899.

Captain W. C. WALTON, I.S.C., called and examined.

24,129. (*The President.*) You are in the Indian Staff Corps?—Yes.

24,130. What is your official position with regard to plague?—I am Magistrate of the Cantonment, and I am in charge of all plague operations in the cantonment.

24,131. (*Mr. Hewett.*) The cantonment was the first part affected here, was it not?—I have been looking back in the old correspondence, and I find there was a case in Bhimgar on the 9th of March 1897, which is a village joining on to the Sadr Bazar.

24,132. Was that an isolated case?—Yes, and apparently imported.

24,133. Do you know where the patient came from?—It was brought by a Mali from Poona. His wife had died there of the disease.

24,134. Did any people get the infection from this man?—I do not know where they got the infection.

24,135. At that time did you hear of any more plague cases?—No, at least I cannot trace any. I did not come here till December. On looking up the correspondence, I find that there was a case.

24,136. When was the first case in the cantonment? On the 27th of September, 1897.

24,137. Was this man a private servant?—He was a bullock driver of the Roman Catholic Chaplain.

24,138. Had he any connexion with Bhimgar?—He went out to buy grass for the bullock. It was a rainy day, and he got wet, and whether he went to Bhimgar, or whether he went among the gawlis in the Sadr Bazar, is not known.

24,139. Did any other servants of the master of this man get plague?—Four of them died in hospital with plague, the bullock driver, the cook, the daughter of the cook, and also the cook's son.

24,140. Who were the next people affected after these servants?—The gawlis were the next.

24,141. Was there much intercourse between the gawlis and the Kunbi who was first affected?—He might have gone to buy grass from the gawlis. Of course they keep cows, and that is the only way I can connect them.

24,142. Would it be likely that there would be social communication between them?—Yes.

24,143. I understand that the outbreak among the gawlis took place on the 3rd of October, 1897?—Yes, that is the first case heard of.

24,144. And after that you had a search of the Sadr Bazar on the 8th of October?—Yes, a search was made.

24,145. What orders were then given to the residents of the Sadr Bazar?—They were ordered to vacate their houses within 24 hours and take up their residence in a camp.

24,146. What was the population of the Sadr Bazar?—About 3,000.

24,147. And how many of them took up their residence in the camp within 24 hours?—1,600.

24,148. What happened to the remaining 1,400?—They scattered all over the country, and I do not know what happened to them.

24,149. Then after the people occupied the camp, did many cases of plague occur among them?—A good many cases, yes. In a short time it went up to 66 cases.

24,150. Up to Christmas were how many there?—There were 75 cases. By the 28th of November there had been 66 cases and 49 deaths, and the people and their clothes were then all disinfected.

24,151. By Christmas 1897 there had been nine more cases?—Yes.

24,152. How do you account for the occurrence of cases in the camp?—I do not account for it, but the Principal Medical Officer of the Poona district came here, and he accounted for it by the fact that the clothes had not been disinfected.

24,153. You mean before the 28th of November?—Yes.

24,154. But after the disinfection on the 28th of November, there were other cases?—There were a few dropping cases.

24,155. How do you account for the cases having occurred?—I cannot account for them all. I know one particular case I accounted for was that of a man who had strict orders that he was not to go to the city which was infected at that time, and he went to the city, and slept there.

24,156. Do you think that other inmates of the camp were doing the same thing?—Very few; we had policemen on the roads.

24,157. Did you have any cases of plague in the camp after Christmas day, 1897?—No, that is the last case in the camp. There were other cases in the cantonment.

24,158. In other parts of the cantonment?—Yes.

24,159. In what parts of the cantonment were there cases after Christmas, 1897?—There were cases in the Kotla, in the Regimental Bazar, and, I think, amongst the Native troops.

24,160. Were the cases very numerous there?—The Kotla is a walled enclosure inhabited by Muhammadans, and I got information one morning that there was a case of plague there. I rode down, and found two dead bodies, and everybody cleared out; and about four or five of them died in the surrounding country to my knowledge. They were found by various Mamlatdars, and brought in.

24,161. These people who left the Kotla were under no supervision after they left?—They cleared out before we knew anything about it.

24,162. Were there cases in any other parts of the cantonment?—There was one case in the syces' lines of the Royal Artillery.

24,163. Only one case?—Yes.

24,164. Did you find it necessary to evacuate any other portion of the cantonment?—The Regimental Bazar was evacuated, but they did not run away; we caught them all.

24,165. How many cases were there before and after evacuation respectively?—On the 9th December a case occurred in the Regimental Bazar, in the Native Infantry.

24,166. How many cases occurred in the Regimental Bazar before and after evacuation respectively?—Only one.

24,167. That case occurred on the 9th of December; when did you evacuate the place?—The same day.

24,168. And you had no further case?—No.

24,169. When you evacuated the Sadr Bazar, and the other places that were evacuated, did you do anything to the houses?—They were unroofed and washed with perchloride of mercury and afterwards whitewashed.

24,170. After what date was that?—It was commenced as soon as the Sadr Bazar was vacated, on the 8th of October.

24,171. Did you have any cases among the people who went back to whitewash or cleanse their houses?—All the work was done by a gang of coolies. The people did not do their own houses. The whitewashing was done whilst the roofs were off; that was all done by a gang of coolies. I have not any certain information about it, but I believe one or two coolies at first took plague.

24,172. Was disinfection by means of perchloride of mercury carried out in every house of the Sadr Bazar, the Regimental Bazar, and the Kotla?—I cannot answer for the Sadr Bazar. I think they were all done. All the infected houses were done, but not the uninfected houses.

24,173. Did you do any uninfected houses in the Regimental Bazar?—One on each side of the infected houses.

24,174. Did you unroof only the infected houses or all the houses?—In the Sadr Bazar they were all unroofed, and the houses in the syces' lines and the Artillery were all unroofed, but I did not unroof all the houses in the Regimental Bazar.

24,175. When did you permit the people to go back to re-roof their houses?—On the 25th of January orders were issued that they might go in by day for re-roofing purposes.

24,176. When did you permit them to re-occupy the bazar?—On the 19th of March, 1898.

24,177. When were they permitted to re-occupy the Regimental Bazar?—At the same time, I think.

24,178. And the Kotla?—Yes, all of them.

24,179. Since they were permitted to re-occupy these places, have there been any cases of plague in the cantonment?—There have been two cases this year.

24,180. Where did they occur?—One was rather a strange case in the Royal Artillery syces' lines of a woman who had just borne a child, and she was taken off to the hospital. They said she had plague, and she died.

24,181. When was that?—Three months ago.

24,182. Had she come from outside?—As far as I could understand there was no reason why she should have plague.

24,183. The second case?—The second case was in a paddock in the Remount Depôt.

24,184. Did the patient come from outside?—It is rather a long story. A boy aged about 15 years died in this paddock. About six men with their families were looking after the horses in the open paddock, and they were living in six bamboo huts absolutely segregated, so to speak. The boy died there, and the Hospital Assistant saw him and said he had no signs of plague—that he died of relapsing fever. No particular precautions were therefore taken. A fortnight afterwards a baby died in these same six huts, and the Hospital Assistant again said there were no signs of plague whatever; the baby had died of ordinary fever. Then a third baby died three days afterwards, so I went down to see what they were dying from. The men themselves said they were located on an old graveyard, which was very unhealthy. I burnt down all those bamboo huts and sent them into another paddock. The mother of the baby had fever, and she recovered next day, and that made me think there was no plague. About three days after that another baby got fever, and then I sent them all to segregation camp, and disinfected their clothes. The baby died in camp. They were practically segregated in the second paddock which I sent them to, but I did not disinfect their clothes. After sending them to the segregation camp, I disinfected all their clothes. They have been out now about a week, and they have not had any fever.

24,185. Who decided that any one of these cases was a case of plague?—The Hospital Assistant who saw the baby that died said there were no buboes and no signs of plague, and the senior Medical Officer, Colonel Lane, saw the baby, and told me that it had buboes, and that it was plague: that is the last baby that died.

24,186. Did he make a report to you that this was plague?—After it died he did; it died in the segregation camp.

24,187. Who decided that the case of the woman who died in the Royal Artillery syces' lines was a case of plague?—The Civil Surgeon, Major Willis.

24,188. You were not able in that case either to trace any communication from outside by friends or relations of the woman, or to ascertain whether it was brought by clothes or anything of that sort?—The people had a right to go to the city or to any other villages. The woman was just going to bear a child, and it is not likely that she had been travelling about the country.

24,189. Was there plague in the city at that time?—There were a few dropping cases.

24,190. Has the death-rate in the cantonment during the year 1898 been above the normal?—No, much below.

24,191. Have you carried out any subsidiary measures for the improvement of the sanitation of the cantonment?—Yes. While they were out in camp I went and took up all the private latrines, and destroyed them, and disinfected them with perchloride of mercury, and then when they came back they were not allowed to have any private latrines, except very special ones. Also, in rebuilding their houses, they had to build on a particular pattern, allowing for lots of ventilation, big doors, and a good height to the roofs, &c.

24,192. You also condemned a certain number of houses?—Yes, we condemned some, and made one or two new roads right through them in some places.

24,193. (*The President.*) The result of your evacuation was successful on the whole, was it not?—Very successful directly the clothes were disinfected, but not before; the same as with the case in the Remount Depôt paddock.

24,194. What do you think is the essential requirement in order to obtain success in evacuation?—I think the great thing is not to allow the ground to be soiled by people evacuating all over the ground like they do in these places. You see people making a latrine of the road in most of these Indian cities. I think it is a very important thing that that should be stopped, and it can be stopped, I know.

24,195. In the evacuated camp, you mean?—No, in the bazars.

24,196. I am talking about evacuation. For instance, on removing people into camp, I thought you said that was successful in your experience?—It was successful after their clothes had been disinfected.

24,197. And in order to obtain the highest success by evacuation, what are the chief requirements to stop the epidemic? Under what circumstances would you be most likely to succeed in stopping the epidemic when you have adopted evacuation?—If you disinfect the people's clothes, and always make them sleep in camp.

24,198. The evacuation must be complete, and they should be segregated?—Yes, allowing them to go to business by day.

24,199. Is evacuation more likely to be successful if it is carried out just after the epidemic has commenced, or in the later stages of it?—It should be carried out at once.

24,200. Therefore, one of the greatest requirements for ensuring success is what?—Evacuation at once.

24,201. That I should think would imply early information?—Yes.

24,202. After you have disinfected, cleaned, and ventilated, have you found that the people who returned did not again acquire plague?—No, they did not.

24,203. You spoke of the structural changes which you have made; did these include windows where they were required?—Yes, two windows in each room, and a ventilator in the roof.

24,204. In what spirit have the people taken these changes?—Very well indeed.

24,205. Do you think they appreciate any advantages from these changes?—I do. They block their windows when they can, but I always unblock them. They like the ventilators. I always say to them, "You "were more healthy in camp than you were anywhere "else, and if you block up your windows, you will be "put into camp again, and you will get more air "there." They get more air in camp than they do in their houses.

24,206. But do they quite appreciate the advantages of the alterations?—They prefer a stuffy house, I think, but they do not grumble about it.

24,207. Do you think you could teach them the advantages of not blocking up their windows?—I am sure of it; they all see that they are more healthy here.

24,208. You said they blocked their windows, but when you tell them not to do it, do they still persist in it?—There is no doubt they do; they have to be opened up every morning.

24,209. By others than the inhabitants?—Yes, but they do not take it in a bad spirit at all. I think they appreciate the advantage of it, although they do not appreciate the comfort of it.

24,210. In regard to the whitewashing, I think you said that some coolies became affected when they were whitewashing?—When they were unroofing.

24,211. Previously to this unroofing, had any disinfection been carried out in these houses?—I cannot tell I was not here then. Every time when I have unroofed a house I have always disinfected first, and I have never had coolies affected then.

24,212. Those were cases which came under your observation, in which the unroofing was preceded by chemical disinfection, and in those cases there was no plague among the workmen?—Never. I have had coolies lifting plague patients in their arms, and showing the greatest pluck, and I have never had any plague amongst them.

(Witness withdrew.)

Khan Sahib B. S. Cardmaster.

7 March 1899.

KHAN SAHIB BYRAMJI SORABJI CARDMASTER called and examined.

24,213. (*The President.*) I believe you are Chairman of the Ahmednagar Municipality, and member of the Ahmednagar City Plague Committee?—Yes.

24,214. Has your plague experience extended throughout the whole time of the several epidemics?—Yes.

24,215. In what years had you plague in Ahmednagar?—We had some imported cases in 1896. Then we had also imported and indigenous cases in 1897 and 1898.

24,216. With regard to 1896, was there any epidemic following the importation?—No.

24,217. How do you think you escaped the epidemic at that time?—We had precautions at the railway station. We only had imported cases. There was no centre of plague in the surroundings. As soon as we detected any arrivals from Bombay or Poona, or from an infected place, we kept an eye upon them and had them inspected, and if we found anything wrong we drafted them to the hospital. There was another reason. That year was perhaps the driest year in Ahmednagar. There was a famine and scarcity of water. There was no centre of plague in the vicinity.

24,218. One of the points you have stated in your précis is that each imported case was kept under observation?—Yes.

24,219. So that you obtained immediate information?—As soon as an arrival from Bombay or Poona came into the station we registered his name, and a report was sent to the Municipality. As soon as we received the report we kept an eye over that man and watched him.

24,220. What did you do with him if plague occurred?—If he showed symptoms he was at once taken to the Plague Hospital and treated there, and the contacts and the family were also segregated.

24,221. And the house?—The house was disinfected.

24,222. In what way?—In 1896 perchloride of mercury disinfection was not prevalent. The house was whitewashed, and certain parts of the roof were cut open. The floor was also whitewashed—the outside and inside of the house and floors were whitewashed.

24,223. You did not employ any powerful chemical disinfectant?—No, not in 1896.

24,224. On the other hand you did open the roof?—Yes.

24,225. Could you tell me how many imported cases you had in this way to deal with in 1896?—There were 26 cases.

24,226. What was the population of Ahmednagar at that time?—36,000—perhaps more at that time—about 38,000.

24,227. In 1897 what was the history of the importation of plague?—So far as I have gathered, I think the importation came from the cantonment. In the last week in September we heard of cases occurring in the cantonment. We heard that a certain reverend gentleman had come from Bombay, and that one of his servants was attacked with plague. At that time the cantonment authorities had no separate hospital of their own, so that the patient was brought to Sidhibagh Hospital. For a month or so there was nothing in the city, but in the last week of October there was one case of plague—a Muhammadan, who had been to the cantonment. He was a native of Ahmednagar, but he had been going to the Sadr Bazar in the cantonment.

24,228. He took plague?—Yes, he had plague in the city. He was found in the city. As it proceeded we found that a great many people had escaped from the cantonment, and had sheltered in the city limits. We inquired into the history of the case, and it was established that the people had plague from the cantonment limits. The locality first affected was the nearest to the cantonment limits with only a wall intervening. There is a big open space, and most of the people who had dealings with the cantonment people lived in that locality, where plague was traced in Ahmednagar at the beginning.

24,229. I understand you did not get very early information of these cases—not so early as in the instance of the imported cases from the railway station?—No. In 1897 we had what we call the death-certificates system here. As soon as there was any death from any cause whatever a Hospital Assistant went there and certified the cause of death. The body was then taken out to the ghats for burial or cremation, so that there was no possibility of escaping or concealment. If there was a death, the death would be at once reported, and the cause of it. I should think that the first case detected so was very probably the first case of plague.

24,230. You got the first case by the death register?—Yes.

24,231. But these cases may have remained living and affected with plague in their houses for a considerable number of days before you found them out?—That was so with one Muhammadan family, and also with one barber's son. The boy was ill for about five or six days, but we only learned of plague there after the death of the boy.

24,232. During these five or six days is it possible that he may have disseminated plague by persons seeing him, or otherwise?—We made inquiries about it. Perhaps it was possible that the plague could be disseminated, because in the neighbourhood of it—the very next house—there was plague.

24,233. Subsequently?—Yes.

24,234. What was the further history of the 1897 epidemic?—We actually found plague travelling in a line always from house to house and from ward to ward. When we found plague broke out in ward No. 5, where the barber's son was, we found it was actually disseminating itself. We found numbers of cases there. We evacuated that ward first by blocks and then the ward. As we went on evacuating, the parts evacuated remained safe, and plague was actually found in those parts which were not evacuated.

24,235. In the contiguous part?—Yes.

24,236. And so it extended?—Yes.

24,237. What was the date of the first infection of 1897?—29th October.

24,238. Can you tell us what was the total number of cases of plague in that epidemic?—There were in all 407 cases.

24,239. What was the mortality?—Out of that number 92 recovered and 315 died—the period ranging from the 29th October 1897 to March 21st, 1898.

24,240. By the 21st March had the plague subsided?—Yes, it had.

24,241. In 1896 was there any special mortality among rats?—No.

24,242. In 1897 was there any special mortality?—No.

24,243. Will you describe the measures you adopted in the 1897 epidemic: you have already gone so far as to say that you evacuated?—Yes. When we found a house infected the first step taken was to carry the contacts to the hospital and the neighbouring people to the segregation camp. They were kept there for 10 days. If there was a second case in the same family 10 days were counted from the second date upon which the last case occurred. Soon after the patients and the contacts were removed, the house was disinfected with perchloride of mercury and the roof opened up. As a rule, we cut a hole three feet by two feet in the roof. If there were windows in the wall they were opened up, and the house was left open for a month or so, and nobody was allowed to enter it.

24,244. That refers to a house in which a plague case occurred?—Yes.

24,245. You also spoke of the neighbouring houses being emptied: what did you do with those houses?—In the beginning we started blocks—that is, a certain number of houses was taken on each side. The Civil Surgeon was generally present, and he would decide that certain houses on each side should be vacated and disinfected. The neighbouring houses were also disinfected, and opened up as long as plague had not assumed an epidemical form. But once the plague had assumed the epidemical form, then the people were asked to leave in numbers, in lots, and the houses were all opened up and the windows were opened. All the houses were, so to say, disinfected and whitewashed.

24,246. You adopted the same treatment as you would when disinfecting a plague house?—Yes.

24,247. You found that your first measure did not succeed in checking the progress of the plague to neighbouring houses, or to other parts of the town, did you not?—Yes, because when we found cases were occurring, although the neighbouring houses were evacuated, we thought that the block system would not do, and therefore we went to the ward system of evacuation.

24,248. Very small evacuation was insufficient; therefore, you tried a larger evacuation?—Yes.

24,249. What was the success attained by the larger evacuation?—As soon as a ward was evacuated, we found the mortality in that particular ward subsiding at once.

24,250. You mean among the people who were in camp?—They were asked to go and live in the fields. The Municipality did not give them any encampment. The open fields were the place where the people used to go to.

24,251. What is the history of the epidemic in the fields?—We have not sufficient data as to the field mortality. Still, from the reports I received, I found that the mortality was comparatively very little.

24,252. Trifling relatively to the condition of the city?—Yes.

24,253. To what extent had you to proceed in evacuating by wards?—We went on evacuating, ward by ward. We first evacuated Ward No. 5, then No. 4, and then No. 3. We evacuated Ward No. 8 last. I found until the last ward was evacuated, plague was appearing in those very places where people were actually found. We went on evacuating ward by ward. A certain number of people were allowed to stay in these wards who were disabled and blind, and could not go out. However, as we went on evacuating, we thought that we would keep the other parts safe—those parts which were not evacuated, and which had not got plague at the time when plague broke out in the wards here which were evacuated. Although we took special care to see the people who were asked to leave one ward did not go to other wards, still plague was found in those very wards which were not evacuated and which had not plague in the beginning.

24,254. Indeed, the evacuation even on the more extensive scale of ward evacuation was not sufficient to prevent the plague extending throughout the city to parts not evacuated?—That is so.

24,255. Did you evacuate the whole city?—Yes, we evacuated the whole city in the middle of March. We had to keep a certain number, who were blind and too ill to be removed, but they represented a very small number.

24,256. Did you follow out the same treatment in the evacuated houses as you have already described?—Yes.

24,257. What was the history of the epidemic among the evacuated after the entire evacuation had been effected?—Among the evacuated, those who had gone out to fields, the mortality was comparatively very small, and the general health was good.

24,258. At what season of the year was it—the dry season?—Ward No. 5 was evacuated in January, and by the middle of March, the whole of the city was completely evacuated.

24,259. You were still in the dry season?—Yes. We allowed the people to enter in the middle of April.

24,260. They commenced to return then?—Yes. The wards first evacuated were allowed the opportunity of taking in men, and the whole city was again full. A good many people had left, but all the wards had an opportunity of taking in people by the end of May.

24,261. You had no inconvenience from the wet season during this operation?—No, we had not. We had a very sharp shower of rain about the end of February, 1898, and that, so to say, put a good many people to trouble and inconvenience. There was also a good deal of cough, and the mortality was not at all high.

24,262. You mean the mortality from other causes than plague?—Yes.

24,263. You think it was low?—Yes, it was low; but even with that shower and the cough and all that, it was not at all high—not so high as one would have expected it in the city.

24,264. Did you notice if plague commenced in any parts of the town which, in their sanitary or any other condition were different from other parts?—I noted that the part where the plague first broke out was the part which is most unhealthy; where there is no drainage system.

24,265. But this part also had this condition—that it was nearest to the infected cantonment, had it not?—Yes. The people had begun to leave the other parts of the city, and there was no possibility of discovering the particular item of insanitariness. There are other parts of the city equally bad in point of sanitation, I admit, but still we had not an opportunity of ganging that condition on account of people beginning to leave of their own accord.

24,266. Where did they go to?—Mostly all the people camped in the fields about a distance of two or three miles from the city.

24,267. They were not specially under control in the fields, were they?—They were put under control by the Collector's staff. The Akbari Inspectors were put on. One reverend gentleman, Mr. Smith, was also put in charge of the outskirts.

24,268. Do you think that any of these people went further than the camps—went into the neighbouring villages or towns?—Yes, they did; not after plague had assumed an epidemical form, but at the time it had broken out.

24,269. Why did they run away in that way?—I suppose on account of the experience they had had in the cantonment and Sadr Bazar.

24,270. What point in that experience caused them to run away?—They came to know that in the Sadr Bazar people were being asked to go out and leave their houses.

24,271. Do you not think it was rather the plague measures than the plague itself that they feared?—I should think so.

24,272. Within your knowledge are there any instances of plague having been imported into a place previously non-infected by this running away of the people? When the people ran away from Nagar did those people who went into other villages or towns infect any of those villages or towns?—Not so far as I know. I do not remember, but there were cases in the fields.

24,273. You have described among your measures the making of openings in the houses?—Yes.

24,274. Why did you find that desirable?—Openings were made so that the rays of the sun could penetrate into the rooms, which were generally very dark.

24,275. What sort of ventilation is there, generally speaking, in the houses?—There are very few openings for ventilation in mud houses. If there are any they are very small. They are not suited to bringing in the rays of the sun direct. The best remedy was to have openings made in the roof.

24,276. Now we will come to the epidemic of 1898. What were the chief features of the commencement of this epidemic?—The chief features noticed about the 1898 epidemic were that rats were found, while they were not found in the 1897 epidemic. The Sisters of the S.P.G. Mission complained that they found a good many rats dying. We found that two girls were suffering from plague.

24,277. Were these the first cases which came to your knowledge?—Yes, in 1898.

24,278. Therefore, before these cases occurred there had been an observable mortality among rats?—We did not observe any mortality among rats in the city, nor outside. It is only that feature, the S.P.G. catching plague, that brought to our mind the mortality of rats in that direction.

24,279. And that mortality occurred before the first cases in that part of the town?—It is not within the town; it is just outside the town—2 miles or 1½ miles out of the town.

24,280. Is it within the Municipal boundary?—It is not strictly within the Municipal boundaries—it is a little further up.

24,281. Will you describe the introduction of plague into the Municipal boundaries?—This year we found some cases in the Maharwada. That is outside the city gate. We have not yet ascertained how that part of the city came to be infected this year. What we have found out is that the surrounding villages were first infected this year. That is one feature of this year

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which was rather peculiar. Before the city could be infected, most of the surrounding villages were found to be infected, and we were taking care not to allow these people to come in. The part that was infected last month in Nagar is the part called Maharwada. It is suspected that those people must have mixed with other villages, or that people from other villages that were turned out must have mixed with the people here. During the last three or four days we are marking one particular feature, namely, that the fields which had plague last year are now showing cases this year too. Though the city was free for a number of days—for a number of months even—cases cropped up in the fields; and it is not understood how the fields could be infected, but there was no infection in the city.

24,282. But there was infection in the surrounding villages?—Yes, there was infection in the surrounding villages.

24,283. Those are the chief features?—Yes.

24,284. Will you kindly describe what you did in this second epidemic—what were your measures—were they the same?—Yes, they were the same as on the previous occasion.

24,285. When did you effect evacuation during the second epidemic?—We only evacuated blocks. We have not turned out the wards yet. We thought, as it was simply beginning, we would try the system of evacuation by blocks; and we have so far succeeded in keeping in check plague in one part of the city, called Nepti Gate.

24,286. Has it been restricted to that part?—We found one case and one death in one part of the city in October, 1898. We evacuated about 40 houses, and turned out about 300 people. We were successful as regards that arrangement. Plague did not advance.

24,287. In that part of the city?—Yes.

24,288. What about the other parts of the city?—The other parts of the city also remained safe.

24,289. What has been the number of cases in this second epidemic?—Up to date we have had 37 cases.

24,290. Have these occurred in the city chiefly, or outside?—The number in the city is comparatively very small.

24,291. How many, do you know?—About five or six.

24,292. The 1898 epidemic has been quite unimportant?—It has, because we are safe.

24,293. At present you have nothing to cause anxiety here?—No.

24,294. These cases chiefly occurred in the encampments?—Yes, in the fields.

24,295. Where the people have voluntarily gone out?—Most of the people had left last year, and had built huts in the fields. They have not yet returned.

24,296. The people in the fields, I suppose, might quite well communicate with neighbouring villages?—They may, or the people in the neighbouring villages may communicate with them.

24,297. I presume that is including infected villages?—Yes.

24,298. So that there is no mystery about the origin of these cases in the fields?—I think it is rather a mystery.

24,299. What is the mystery?—The origin of it.

24,300. Do you mean the origin of any particular individual case?—From inquiries, we have learnt that though it is quite possible and probable that there may have been communication, still the people themselves say that they have not moved out nor have they allowed people to mix with them. People who are known to have come from infected villages are watched, and are not allowed to mix with other people.

24,301. How complete is the watching; is it impossible or even very difficult for them to go beyond the boundary that is watched?—It is difficult, but it is not impossible.

24,302. Have you formed any special views with regard to the methods of communication of plague?—I should think particularly by contacts.

24,303. Do you think that the communication is chiefly by human agency or by some other means?—Principally by human agency.

24,304. Have you any instance in which clothes, apart from men and women, have been the channel or the means of conveyance of plague?—I have not had any special opportunity of noting that. I have had reports like that, but I have no special knowledge of persons secreting clothes or concealing clothes and getting plague.

24,305. You had reports, but it did not come to your own observation?—No.

24,306. The official report would be very useful?—I have not traced that report out.

24,307. It is only an impression, therefore, in your mind that it may be so?—Yes. That is my impression from the reports I have received from people.

24,308. Do you think that rats have a share in the communication of plague?—Only from what I have heard and seen with regard to the S.P.G. Mission.

24,309. Only from that instance?—Yes.

24,310. Do you know if other animals besides rats have had plague?—I saw cats.

24,311. What do you think are the features which are most conducive to the spread of infection? You draw attention to floors, want of ventilation, and general insanitary conditions, do you not?—Floors of houses have much to do with the communication of plague. Most of the people here sleep on floors and move bare-footed in their houses, and therefore run the risk of infection. Roofs of houses here contain so many crevices and holes that they form good harbouring haunts for plague germs in spite of disinfection with perchloride of mercury. Want of ventilation is very healthy for the thriving of plague bacilli. Houses here are so constructed that they have very little ventilation, and even that is closed during the night. There are certain houses which even require a light in the daytime. Weak health and bad feeding also encourage plague. This was verified by the numerous attacks that took place amongst the Sali, Kosti, and Kongadi people. These were the people who had suffered most in the famine, and no sooner was famine over than plague overtook them in their half-famished state. Milch-cattle stables, unless they are built upon sanitary principles, with outlets for the proper discharge of urinary matter and dung, also prove very flourishing to plague, and, with this in view, the then Civil Surgeon, Dr. Stevenson, advised the Municipality to drive out all cattle and provide for them suitable stables outside the city.

24,312. With regard to the various steps you have adopted, which do you think is the most effective?—Evacuation.

24,313. You have a very clear opinion as to that?—I am quite positive.

24,314. I suppose it is a natural inference that the more complete the evacuation the more effective it is as a measure?—Yes, and much more if it is undertaken in the first stages of plague.

24,315. Would you express any opinion as to the value of disinfection in itself—of habitations, I mean?—I am rather sceptical about it.

24,316. On what grounds?—On the grounds of the construction of the houses in the mufassil towns. There are so many crevices and so many things to look after. I do not think disinfection with perchloride of mercury can thoroughly reach those crevices and holes which are found in numbers in the houses. However satisfactorily it may appear to be done it will not be perfect.

24,317. Have you any instance in which the value of perchloride of mercury has been tested and shown to be inefficient?—I cannot mention any specific instance.

24,318. You believe in the efficacy of the influence of sun and air?—Yes.

24,319. But you have no case in which you have established the insufficiency of chemical disinfection?—No.

24,320. Have you any knowledge as to the possibility of food substances conveying plague?—No.

24,321. None at all?—No.

24,322. You have had, I think, to entirely disinfect and clean this city twice?—Yes.

Khan Sahib B. S. Cardmaster.

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24,323. What has been the general result of that upon the health of the city apart from plague?—I have found cholera disappear, and noted, particularly last year, that cholera had entirely disappeared. Generally speaking, we have cholera in July and August every year, and we have a mortality of about 50. I noted the complete disappearance of cholera last year.

24,324. Have you anything to say with regard to the water supply? What does the water supply of Nagar consist of?—Old aqueducts. Water is brought into the city under masonry galleries to a certain distance, and under a new scheme it is brought in in iron pipes.

24,325. Even since water has been brought here in that way cholera has been fairly prevalent until last year?—Yes.

24,326. Have you any statistics to show the mortality during the last two years as contrasted with any previous periods?—Yes.

24,327. Does that bear out your contention as to the increased healthiness of the city within the last two years apart from plague?—Last year, just at the time plague was raging—say from November to March—we did not get any complete statistics because the people were out in the fields. What was shown in the mortality statement last year was rather vague and I should not like to trust that.

24,328. This year?—This year we found mortality in certain weeks rising, and in certain weeks falling, but contrasted with previous years it was almost an average.

24,329. Then there is nothing actually to prove that there is increased healthiness, but only that cholera has diminished?—Yes.

24,330. I think you noticed something in connection with rats in this city after plague had appeared?—After the disinfection and evacuation of the city, a disappearance of the rats was noticed in 1898.

24,331. There are now almost no rats—they have been reduced greatly in numbers?—Yes.

24,332. I think you have already stated that in 1897 a mortality among rats did not precede plague?—Yes. In 1897 we did not mark the mortality among rats, and in 1898, so far as this city is concerned, there has been no complaint as to rats being found. There is only the S.P.G. Mission case where rats have been found.

24,333. Is there much overcrowding in the localities of this town within the houses?—In certain wards there is overcrowding.

24,334. Was there any observable relationship between the incidence of plague in these wards as contrasted with other wards?—In Ward No. 6, which is the most overcrowded part of the city, the mortality during plague time was high; but that ward has been inhabited by people who are more intelligent than the people in the other wards. The people left, however, as soon as they found that the other wards would have to suffer.

24,335. (*Mr. Hewett.*) You say that plague occurred in 1898 in the fields in which it took place in 1897. Do you mean that it occurred in the same hut or in the same collection of huts?—I am not sure whether the huts were dismantled last year and reconstructed this year, but the cases occurred in the same area.

24,336. Do you know whether the huts in which plague occurred last year were always disinfected?—I am not sure.

24,337. Might it be possible that the infection may have remained there?—It is possible.

(Witness withdrew.)

Mr. MOHANLAL HIRALAL called and examined.

Mr. Mohanlal Hiralal.

24,338. (*The President.*) I understand that you are a member of the Ahmednagar City Plague Committee?—Yes.

24,339. (*Mr. Cumine.*) You are a volunteer witness, are you not?—I was asked by the Collector to give evidence.

24,340. You are not an official?—No.

24,341. You have heard what Mr. Cardmaster told us?—Yes.

24,342. Have you any interesting facts to bring before us in addition to those he has given us?—In the year 1896, when the first cases occurred here, no steps were taken to disinfect the houses. The infection having come in the summer months it did not affect this town at all. There were six or seven cases, and we did not adopt any steps in 1896, because it was during summer. The plague did not remain here at all. The inmates of the same houses and the neighbouring houses were not affected. In the summer climate even importations had no effect here. It was in the winter season when plague came in 1897. It was about the end of January that the whole town was evacuated. Mr. Cardmaster said it was about the end of March that the whole town was evacuated, but I think it was about the end of January. For nearly three months the inhabitants were out. The opening of the houses to the influence of the sun had a very good effect. I do not believe in the process of disinfection with perchloride of mercury. I know of my own knowledge that it was not fully carried out according to the directions of the Civil Surgeon or the medical men. The houses are so peculiarly constructed that every portion of them cannot be satisfactorily disinfected, and the workmen did not do the work satisfactorily. Still, the opening of the houses, and leaving every room open to the rays of the sun had the desired effect. I am inclined to think that the sun did the work of disinfection more than the perchloride of mercury. That is my impression about it. This year we have simply had sporadic attacks—cases here and there.

24,343. Why did not these sporadic cases spread plague?—In my idea it is owing to the effect of last year's disinfection, namely, the houses having been opened up to the sun. The cases came to our knowledge very early, and steps were taken to remove those people. The infection could not travel.

(Witness withdrew.)

Mr. EDULJI RUSTOMJI, called and examined.

Mr. Edulji Rustomji.

24,344. (*The President.*) You are Vice-President of the Ahmednagar Municipality?—Yes.

24,345. And Chairman of the Plague Committee?—Yes.

24,346. (*Mr. Cumine.*) You go over pretty much the same ground as Mr. Cardmaster, do not you?—Yes, very nearly the same, except that in my précis of evidence I have noted some special facts to mention.

24,347. Do not go over the same ground, but kindly mention any special things that he did not touch upon?—I have in my précis mentioned that infection came first from Bombay, subsequently from Poona, and lastly a case from Kirki. I have given all the details, and described how the first case, an imported case, came into the city of Ahmednagar. One of the Padamsalis, by name Ramaya, came from Bombay. I have stated all about that in my précis. I have also stated in my précis that the climate was peculiarly chill and cold about the time that plague was raging in Ahmednagar, and also that at the same time there was a scarcity of water. The weather and the atmosphere, although chill, was dry. I have also described, at considerable length, how the city was first, block by block, evacuated as it became infected, and subsequently by wards, as has been described by Mr. Cardmaster. I might specially mention that while the system of opening up the houses was being carried out, it came to my notice that there were certain houses in this very town which required candle-light to get a vision in, even during the day, and those houses were the most typical instances which I have, where air and light had never got to them since they were constructed. These houses, such as those I have described in the Cloth Market, were constructed ages ago. These houses were specially treated in regard to ventilation and light, the owners were made to provide windows and roof ventilation, and light from the roof

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was also insisted upon. Another thing that Mr. Cardmaster has not stated, is, that while we were disinfecting and opening up the houses for the benefit of the people, we had a very valuable agency, and perhaps a very honourable one too, in having our head officials—the Executive Engineer, the Civil Surgeon, the Assistant Collectors, and the District Superintendent of Police:—all these had divided the city wards amongst themselves, and they were in their divisions personally and zealously superintending the operations of disinfecting and opening up the houses. These officials were subsequently aided, in order to see that each house and each room was thoroughly disinfected, by European soldiers, and native soldiers were afterwards brought in. Of course, by their presence, I am thoroughly convinced, on inquiry, that there was not a room left in any house of the town, which was not thoroughly done up. I have also noticed in my précis that the Municipality had to do this at no ordinary inconvenience as regards its finances.

24,348. What is the result of the thorough cleaning-up that the city got?—It has reduced the ordinary mortality of the town as compared with the previous five years.

24,349. Have you noticed whether people who sleep on the ground are more liable to catch plague than those who sleep on beds?—Yes, that is my experience of it. I found that several of my own servants, and other people whom I have known, and also on inquiry, have had reported to me that most of those people who were actually sleeping on the ground got attacked with plague and died.

24,350. Have you noticed whether people are more liable to catch plague if they sleep on one floor of a house than on another?—I think so. That is my experience, but it is not based upon a very large number of observations, but I know in one or two cases that people who slept on the higher floors did not get plague, although they were contacts.

24,351. Is there, in your experience, a particular danger in natives going into infected houses without shoes on?—Yes, there have been two instances I have particularly noticed in the case of people going in to do repairs to the S.P.G. Mission outhouses.

24,352. Will you tell us what you think are the best methods of keeping plague out of a district?—Observation camps, disinfection stations, medical examination stations, and a system of medical surveillance are, I think, excellent modes of keeping plague out of any station.

24,353. And immediate evacuation of infected places?—Yes.

24,354. (*Mr. Hewett.*) Have you Voluntary Committees at present to keep under observation people who arrive from outside?—We have a Committee appointed to visit the railway station, one member of the Committee going every day in the week and assisting the Hospital Assistant to examine the arrivals at the station.

24,355. If people come from outside now do you know where they go to live?—Yes, we keep a register at the railway station, and keep the village officers, and the officers of the talukas, the Mamlatdars, informed of people going to their talukas, having arrived by rail.

24,356. Is that what you mean by medical surveillance?—The people that come from infected places are asked to go for medical examination to the City Hospital for 10 days after their arrival.

24,357. That holds good in the city?—Yes. We generally find out if any people are actually suffering. I think there was a case so found, of people examined at the hospital—that there was a case of plague amongst them.

24,358. (*The President.*) Do you remember what was the total number who were in the camps outside the city, at any one time?—Nearly the whole of the city was turned out, and I should think that over 20,000 must have been living in the camps outside.

24,359. Then there are 16,000 not accounted for?—What I think had become of them, was that they had gone to other places. I know some of the Marwaris had gone to Marwar, and some had gone to Gujarat, and some had gone to other places, but I do not know whether the whole of the 16,000 had gone in that way.

24,360. You described the measures adopted in evacuated houses. In some cases you made structural alterations that were required?—Yes.

24,361. Can you tell me whether the people have made use of those structural alterations that you introduced?—We made them provide permanent windows, and openings in the roofs, but in several cases I found they had closed them up, by hanging clothes and pardahs over them. We then asked them to open them up again. It appears that most of the people who live in those houses do not like very free ventilation, and somehow or other, I found in some cases they had closed up the windows that I had provided—only temporarily—they had not permanently closed them up; they could be opened at will.

24,362. Do you think that these permanent improvements will be taken advantage of by the people in time?—I think that the better class of people have been using these windows, and that only the poorer classes tried to shut them up by hanging clothes and curtains and pardahs, or something like that, over them. I think, however, that they will gradually come to appreciate the value of light and ventilation. Of course, in some cases in which the houses were very dark, I have seen that the people kept them open.

24,363. Will you kindly tell me what is your opinion as to the most successful method of dealing with plague epidemics?—From what I have seen from the beginning to the end of plague in Ahmednagar, I am fully convinced that evacuation of infected houses and opening them up to sunlight and ventilation and whitewashing and otherwise thoroughly cleaning them up is the best remedy to escape wholesale ravages by plague; that plague sticks most and does greater mischief in dark, ill-ventilated, dirty houses and localities, and can be stamped out of a sanitary house much easier and quicker; and that by people living in the open, they not only escape attack of plague but get better and stronger as regards their ordinary and general health and constitution. I have heard several people say they have been feeling stronger and better after their stay out in the open in huts and sheds.

(Witness withdrew.)

Major C. F. Willis, I.M.S.

Major C. F. WILLIS, I.M.S., called and examined.

24,364. (*The President.*) You are in the Indian Medical Service?—Yes.

24,365. And are a Doctor of Medicine, and a Member of the Royal College of Physicians?—Yes.

24,366. What is your official position here?—Civil Surgeon.

24,367. (*Mr. Hewett.*) Can you give us some general idea of the course that plague had pursued in the villages outside Ahmednagar?—I can only tell you with regard to the latter part of the year. I was not here during the first; I was up at the front then. It commenced this time at Chichondi, a village 13 miles away from here.

24,368. When was that?—I cannot tell you the exact date; it was run by the village authorities. It was about October or November.

24,369. Did it extend from there?—It did not extend at all from there. The people evacuated into their fields, and the plague did not extend. There was no plague in the villages near.

24,370. What was the next place affected?—Savedi, about two miles from here, and about half a mile beyond the Mission, where plague first appeared. There they had a lot of cases. The cases had been returned as usual as anything, until I went there and found two or three cases of plague. The usual measures were then taken, the village was evacuated, and the people turned out into the fields, and that village has been thoroughly cleared out, and no spread of plague, I think, took place from there.

24,371. Have any of the other villages in the neighbourhood of the town been affected?—Towards Poona, there was another village called Khedgaum, which had

plague there. That was about the third village. They had several cases, and from there I think it spread to other villages, to another village called Sonawadi, a village about three or four miles further on.

24,372. Do you know the maximum number of villages attacked at any one time in the district?—I think the maximum would be five. I do not think, even then, they all had cases at the same time, for the first two or three villages have been free from plague now for several weeks.

24,373. Then there has been no serious outbreak?—No; only one or two cases occur now and then.

Major C. F. Willis, I.M.S.

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(Witness withdrew.)

(Adjourned till Wednesday, 8th March, at Nasik.)

At The Collector's Office, Nasik.

SIXTY-THIRD DAY.

Wednesday, 8th March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

MR. J. P. HEWETT. | MR. A. CUMINE.

MR. C. J. HALLIFAX (*Secretary*).

MR. R. A. L. MOORE, I.C.S., called and examined.

Mr. R. A. L. Moore, I.C.S.

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24,374. (*The President.*) I believe you are in the Indian Civil Service, and Collector of Nasik?—Yes.

24,375. And you occupied a similar position in Surat?—Yes, I did.

24,376. Where you had an opportunity of seeing two epidemics?—I did; at the beginning of 1897, and from the middle of 1897 up to May 1898.

24,377. Were these the only two epidemics that occurred in Surat?—Yes; in fact, I saw all the plague that occurred in Surat.

24,378. The first epidemic, I think, commenced in February?—It did.

24,379. And terminated in May?—Yes; May 1897.

24,380. Can you tell us what part of your Collectorate was chiefly affected in the first epidemic?—The chief place affected was Rander. As a matter of fact, putting aside a few imported cases, plague began at Rander. That is a town on the other side of the Tapti, opposite Surat, with a population of about 10,000 people. It spread from there, and subsequently, as far as I can remember, in the month of March it began at Bulsar. It chiefly prevailed at those two places during the first epidemic.

24,381. Can you account for its introduction into Rander?—I made inquiries, and, as far as I can gather, it arrived in this way. There was a vakil who lived at Rander whose wife had a brother at a Gaikwari village called Wariav. The brother came from Bombay to Wariav, and died of plague. While he was ill, this lady, the wife of the vakil, went on a visit of condolence to her brother. She returned to Rander, and herself developed plague and died. From that the disease spread throughout the town. That was the result, from inquiries that were made.

24,382. How long previously to its becoming indigenous did this importation occur?—As far as I remember, a fortnight. I ought to say that when this imported case occurred I was out in the district. I received, first, an anonymous petition and subsequently a letter from the Hospital Assistant at Rander, stating that he believed that there was plague in the town, and that it was being concealed. I immediately came in, and very shortly after my arrival plague became very evident.

24,383. You did not, therefore, get very early information about this importation?—No, not for several days after it occurred. I was in the district, and there was no plague at the time.

24,384. The information was not early enough to allow you to deal with the first case?—It was not dealt with at all.

24,385. Previously to its becoming indigenous was there any marked mortality amongst rats or other animals?—None that I was aware of.

24,386. If there had been, you would have heard of it?—Yes, if there had been any marked mortality.

24,387. After plague became indigenous, how did you treat it?—At the beginning we acted in this way. We had a field set apart, and in this field we put up a Municipal Plague Hospital, and we also allowed any castes who wished to do so to put up their own hospitals. Some castes did put up their own hospitals. Anybody taken with plague was removed to the Municipal or Caste Hospital, as the case might be, with two attendants. At first we started an arrangement of having the women all in one special building, but that was not subsequently carried out, as it was found impossible to separate the sexes owing to the fact that the attendant on a woman would be a male, and *vice versâ*. The husband would come with the wife, and the wife would come with the husband. Then we had the plague house vacated, and all the tiles removed and all the doors and windows opened and barred by bamboos. The place was then thoroughly doused with a solution of perchloride of mercury, one in 1,000, out of a fire engine. At the beginning I also had all the floors dug up, they were chiefly earth floors, to a depth of about six inches and taken outside the town and burnt. That was done to the plague house, and also to the houses on each side. If that was not found sufficient we proceeded to turn out whole localities and treat them exactly in the same way, except that we did not dig up the floors.

24,388. What was the proof of its not being efficient?—That in spite of the house being cleared out, perhaps in a day or two, the next house, or the next house but one, would develop plague, and so on down the street. When I found plague going down a street, I turned the whole street out.

24,389. Was that more efficient?—Yes, I think so.

24,390. That would seem to imply that plague still extended?—Yes, undoubtedly it did still extend.

24,391. In the first place the extension appeared to be by contiguity?—Yes. Possibly, I am not conveying a right impression. The plague did not spread actually to the next house, but it would spread from one house

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to three or four houses down, where there were relations or friends living of the people from a plague infected house. The plague does not begin in No. 1 house, and then go to No. 2, and No. 3, and No. 4. It will begin, say, in No. 1, and then go to No. 4, where the people in No. 1 have some friends or relations.

24,392. Therefore, it may extend across a street?—Yes, or to another street altogether.

24,393. Do you think the method of conveyance is by human agency?—Yes, by persons, and also by concealment of infected kit, clothes, and such like. People, when they are ordered to bring out kit and to have it disinfected, or, in a case of clothes belonging to the patient, to have them burnt, often conceal a part, and it is smuggled off by a friend or neighbour, and the friend or neighbour by so doing takes plague to his own house. I have found that out.

24,394. That house being at a considerable distance?—Yes, it may be.

24,395. Have you any cases in which it has been at a considerable distance?—Yes.

24,396. And you think it was carried in the clothes?—It was in property carried from an infected house.

24,397. Where it was not probable that it was carried by human agency?—Where it was not probable.

24,398. But, of course, you could not altogether eliminate that?—Yes, that is my impression after a couple of years' experience.

24,399. In a general way, was a large proportion of the population affected?—Yes, a very large proportion, certainly.

24,400. Was the mortality considerable?—The mortality was very considerable. I cannot tell you exactly what it was, but I should say it was four-fifths; 80 per cent. of those attacked.

24,401. Perhaps, in a similarly general way, you could give the proportion of those attacked to the population?—As I have had three epidemics to deal with, I get confused in my figures, and I should not like to say.

24,402. What have you to tell us with regard to Bulsar?—With regard to Bulsar, I may say that I had to supervise plague matters generally, and visit places, but the actual work was done by Captain Dyson, as he was then, the Deputy Sanitary Commissioner. The arrangements which I have described with regard to Rander were very similar to those carried out at Bulsar.

24,403. That is to say, the extreme measure was partial evacuation and not complete evacuation?—At first, and then, subsequently, streets were evacuated. The whole town was not evacuated.

24,404. Now we come to the second epidemic, which I think also involved three towns?—Yes, Rander, Bulsar, and Surat.

24,405. Which was the first of these three places affected in the second epidemic?—The first place was Surat in the second epidemic.

24,406. Do you know how plague was introduced into Surat?—Yes; I believe it was introduced by people coming from Bombay, especially people of the Ghanchi caste.

24,407. Who are the Ghanchis?—The Ghanchis are oil pressers.

24,408. Had they fled from Bombay?—They came from Bombay.

24,409. Because plague was in Bombay?—Yes, because plague was in Bombay. I should mention that Surat has a large business connection with Bombay. There are a large number of low castes in Surat who go for service to Bombay; for instance, a large number of people came from the caste called Surtis; they go as syces, cooks, and butlers to Bombay. They became infected in Bombay, and then came back and spread plague in Surat.

24,410. At about what time was the second epidemic?—The second epidemic in Surat began in August 1897—the mortality began to rise then. I am speaking from memory but I think I am right. I left Surat in May, 1898.

24,411. Was the course very much what you have described in the case of Rander?—There was a slight epidemic in the beginning of 1897 in Surat, I suppose about 150 cases. That was at the same time that plague was going on at Rander, and was introduced from Rander. It did not spread much during the first epidemic in Surat. We were very rigid in our measures. We burnt down some of the plague houses altogether. When plague first started in Surat we had houses pulled down and burnt. The plague did not spread much at that time, and then it stopped altogether.

24,412. In addition to partial evacuation, you burnt down some of the houses?—Yes.

24,413. It was a small epidemic?—Yes, about 150 cases.

24,414. Do you remember when it ceased?—I think it ceased in Surat in May 1897.

24,415. Between May 1897 and August 1897 the town of Surat was absolutely clear?—Yes, there might have been a few dropping cases perhaps; as a matter of fact I think there was one case, which occurred in July.

24,416. Was there any case which you could not trace to importation?—No, I think there was one imported case in July, to the best of my recollection, between May 1897 and August 1897 in Surat town; but there was no indigenous plague. Then, in August, the mortality began to rise rapidly.

24,417. Will you describe what measures you adopted in Surat after August?—Plague began in the middle of the rains, and, consequently, we were in a great difficulty. We could not go in for evacuation to any great extent, because we had nowhere to put the people. We did, however, turn out any plague cases we had, and removed them to the Municipal hospital, which we started near the railway station, at a place called the Parakh Dharamsala. We made the same arrangements as before. We allowed two attendants to attend upon each sick person, and we disinfected the houses, but we did not go in for segregating the contacts, because we had nowhere to put them. The people had to turn out of their houses on account of the disinfection. Some of them spread through the town, and some of them were provided with quarters in a building which was put at our disposal by a native gentleman, the Bakshi Sahib of Surat—the leading Musalman gentleman in the place. Then, after a bit, the different castes asked me to be allowed to start their own hospitals, to which I agreed on condition that they should pay all the expenses, and allow the hospital to be under the supervision of the Civil Surgeon. They were to have their own Medical Officers, but to be under the supervision of the Civil Surgeon. Each religion did start its own hospital The Hindus had one, the Parsees had another, the Shiah Musalmans had another, and the Sunni Musalmans a fourth. Finding that there was great concealment, I started house-to-house search parties. Each party consisted of one or two European and some native gentlemen and a party of police. We went round and searched all the suspected quarters. I am bound to say that, as far as the search went, it did more harm than good, because it was almost impossible to conceal from the people where we were going to. The consequence was that they removed patients before we came, and thereby infected fresh houses. Plague went on, and the mortality continued to rise until November, and then Mr. Wingate, who was then the Plague Commissioner, arrived. He said that, in his opinion, we ought to start the ward system in Surat, which we did immediately; that is to say, the town was divided into nine wards. At the head of each ward there was put a European ward officer. They were all officials, except one, Mr. Page—the Bank Agent—who very kindly volunteered. Then, as far as possible, I gave each Ward Superintendent a European assistant, also a Government official, and a lot of honorary assistants in the shape of native gentlemen, who volunteered for the work. In this matter of volunteering I ought to say that the Parsees and Muhammadans were especially good; the Hindus were less ready to help. Under each Ward Superintendent there was a special staff put. We had for each ward one or two fire engines for disinfecting, with a gang of coolies under a Muccadum. We also had a number of police, and we had a staff of sweepers. The Ward Superintendent and his Personal Assistants were supposed to recognise plague as a rule. If they had any doubt they either sent for the Civil Surgeon or the Assistant Surgeon, who was put especially on that duty, and he decided whether that case was one of plague or not. If the case was decided to be plague, the plague patient was removed either to the Municipal Hospital, which we started in what was really the Civil Hospital, with an extension in the High

School—the Civil Hospital being removed into a part of the Jail—or else the patient, if he chose, was taken to his own caste hospital. In case of concealment, by way of punishment, people who wished to be taken to their own caste hospitals were not taken there. Supposing a Hindu concealed a case, and said he wished to go to his own caste hospital, by way of punishment he was taken to the general hospital. We had also a segregation camp for contacts; that is to say, all persons who were living in the house of the patient were taken to the segregation camp which was outside the city, and put under a pensioned Sergeant-Major of Gunners.

24,418. Was that during the rainy season?—It was in November, after the rains had stopped, and after Mr. Wingate's arrival. The segregation camps consisted of tatti huts built by the Municipality, and food was provided for all the people in the segregation camp, and to the poor, also, blankets and warm clothes were provided out of a charitable fund which I got up, and to which the native gentry of Bombay and Bhawnagar, especially, subscribed freely. They were kept in a segregation camp for 10 days, and if they developed no plague they were allowed to go; but they were not allowed to return to their houses in the city without a written order by myself.

24,419. They were allowed to go away?—To go where they pleased. That was after 10 days' segregation. We also found that it was not sufficient to turn out one or two houses when plague occurred, so we turned out whole streets, and then, after a bit, we turned out several streets, whole quarters in fact, and we camped the people down in what we called health camps all round the city. We had four Municipal health camps under official supervision, and there were a large number of small camps which were constructed by the people of their own accord. With regard to these voluntary camps, I had to close them subsequently, as I thought they were sources of spreading infection. There was no supervision over them, and the people used to go into the town and visit plague-infected relations, and come back again and generally spread infection. I therefore had to close these camps subsequently. In the four large health camps the people who had any means had to build their own hut, but people who had no means were provided with matting by the Municipality. In the case of widows and such like, huts were built for them. In each camp we had a staff of police and a staff of sweepers to keep the latrines in order, and we had a Sanitary Officer over the camp; we had Superintendents who were either Eurasians or Parsees. They also had a staff of Karkuns to keep the register of arrivals and give passes to people to go in and out of the camp. They were allowed to go out in the daytime, but they had to come back at night to sleep.

24,420. What is the maximum number of people you had in these camps at one time?—Of all sorts, both in the Municipal and voluntary camps, we had 35,000 at one time.

24,421. Inhabitants of Surat?—Yes, inhabitants of the city.

24,422. Had you many cases of plague in the Government health camp?—We had in one camp especially, which was occupied by the people I mentioned, the Ghanchis, and also by the low caste of people called Golas, rice-pickers. We had to move the site of that camp twice and to burn down the huts and burn the ground. This was partly due to the fact that these castes were excessively filthy in their habits, and partly to the fact that they were allowed to go to the town during the daytime to work for their living, but in reality they used to hire themselves out as plague corpse bearers.

24,423. Was there any provision to prevent overcrowding of the Government huts; was there any limit to the number of people in one hut?—Yes, I think I am right in saying that the maximum number allowed in one hut was five.—If the family consisted of more than five, they were given another hut just adjoining.

24,424. You spoke of 35,000 being camped outside the city?—Yes, at one time; that is in round numbers.

24,425. What was the total population of the city?—110,000. We had about one-third of the population camped out.

24,426. And a considerable number remained in other wards?—Practically, the remaining two-thirds. We took great precautions against people running away from Surat.

24,427. Were those precautions successful?—Yes, in preventing plague spreading out of the Surat district, but not in preventing people going out of the city and into the villages. We could not stop that, but we did prevent plague from spreading from the Surat district. That I am prepared to say.

24,428. Do you know the total number of cases during the second epidemic?—In round figures I should think it was about 2,500 or 3,000.

24,429. Do you know the mortality?—The mortality was about the same, 75 to 80 per cent.

24,430. Did this measure which you adopted again, consisting of only partial evacuation of the city, do much good in your opinion, or not?—I think it lessened the number of cases.

24,431. But it did not stop the progress of plague?—It distinctly did not stop plague, because plague went on from August 1897 to May 1898.

24,432. You began to adopt extreme measures in October 1897, and plague continued till May 1898?—Yes. It had stopped entirely before I left Surat. I did not go until it stopped. I left Surat on the 25th May. Plague stopped early in May.

24,433. In the case of the whole of the houses which had been occupied by plague patients, was disinfection quickly carried out?—Yes, certainly. It was generally carried out the same day, or, at any rate, the next day. We had the fire-engines filled with the mixture of perchloride of mercury continually going round the streets.

24,434. Was it soon after that that the houses were opened up so as to admit air and light?—Yes; the houses were opened up immediately, and they were swept out too. What we did was this. We opened up the house, first swept it out, and then doused it with this mixture.

24,435. What did the opening up consist of?—In taking up nearly all the tiles, throwing open the doors and windows, and barring them with bamboos. In the case of people being recalcitrant, who would not open their doors and windows, we took the doors off their hinges.

24,436. After you commenced evacuating large areas, what treatment was adopted in the houses which were evacuated where there had not been plague cases?—Practically the same.

24,437. Disinfection and opening up?—Yes; and another additional step was taken, namely, the official organisation whitewashed all the houses in which plague had occurred after they had been disinfected, and a general order was given to the populace that, in the case of houses not actually infected with plague, the owners should whitewash them. Nobody was allowed to return without whitewashing their houses.

24,438. Have you any towns in your district where complete evacuation was carried out?—We had no towns; we had villages.

24,439. Can you remember any examples of the complete evacuation of villages; do you remember the general results sufficiently to be able to tell us whether complete evacuation was more promptly successful than the partial evacuation which you have described?—There was one village near Surat, called Umra, which was evacuated, and a place called Adajan which was evacuated.

24,440. Let us take these two places. What result did you obtain by that complete evacuation?—I remember the case of Adajan more particularly as I paid several visits there. I was afraid it would be a stepping stone between Rander and Surat. I cannot say that evacuation completely stopped plague, as dropping cases went on afterwards.

24,441. How do you account for these dropping cases?—Some of the people were infected before they left the village; others, or the same people, took out infected kit, which had belonged to people who had taken plague in the village, and then they developed plague when they got outside. Their friends and neighbours went and visited them, and if one of them died, his caste people came and sat round him and lamented, and accompanied the corpse to the burning pyre.

24,442. There were a few dropping cases?—Yes, cases went on.

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24,443. You spoke of people having gone out who were already infected; these would develop plague in the next few days after evacuation?—I cannot say that. It went on. It is not as if cases occurred within ten days and then stopped. It went on and on.

24,444. You found there was a great deal of intercommunication?—Certainly. When people are camped out it is impossible to stop them.

24,445. Inter-communication with the infected places—with Surat itself?—Yes; people used to go into Bandar from Adajan, which is two miles away.

24,446. Have you had any experience of inoculation?—None at Surat, because there was none. At least, I remember two cases. The result of one was rather unfortunate.

24,447. Had you any experience of inoculation at Bulsar?—Yes. That was during the second epidemic there. There was a very keen and intelligent Parsee Assistant-Surgeon, Dr. Dadachanji. There were two distinct epidemics at Bulsar, the first of which, as I said, was run by Captain Dyson, and the second was run by the Assistant-Surgeon, Dr. Dadachanji. For a long time the latter managed to keep plague out of Bulsar. With my permission he put on very strict quarantine and for a very long time kept plague out. But at last a man sneaked away from Bulsar to go to a marriage party at Bilimora. He came back and developed plague, and started the plague in Bulsar after three months safety through quarantine. When it was finally started, Dr. Dadachanji asked to be allowed to start inoculation, and I said if he could get the consent of the people, so that there would not be any ructions, I had no objection, and consequently he did get some people, who had been instructed by Professor Haffkine, to come up and perform the inoculations. As far as my experience of inoculation at Bulsar goes, it comes to this. I went down and made examinations, and I found the case mortality was about 25 per cent, but plague went on; that is to say, inoculation apparently saved a number of people from dying, but it did not prevent plague from spreading. That is the general impression I got there from what I saw of inoculation.

24,448. What is your general opinion as to the value of disinfection by chemical agencies?—I think it is not worth the money spent on it.

24,449. Upon what grounds do you express that view?—I consider evacuation and leaving the houses thoroughly open for a month equally effective. Unless disinfection is done under skilled supervision, I consider it so imperfect as not to be effective.

24,450. Have you any data to give us which would illustrate what you say?—I can give you the data of the present outbreak in Nasik—the plague which is going on now. We have had no disinfection throughout the district. In the villages, the plan I have gone on is this. I have sent round circular orders to all the Mamlatdars to have weekly reports from the village officers with regard to the mortality of the village. If the mortality rises, or two or three deaths occur in a house, they immediately go and examine the village with the Hospital Assistant, and if they find a case of plague they report it to me. I then send an evacuation order, and the village is turned out at once; the houses are all left open, and if it is a plague house, the doors are taken off and barred with bamboos. The people are not allowed to return until I give a written permit. If they do return they are prosecuted. I do not give a written permit for a month after the last death or recovery from plague. I found that system worked quite as well as disinfection. With regard to what I have said about the imperfectness of disinfection, I speak from personal experience. When I was in Surat, it was my daily work to ride round the city and examine the houses which had been disinfected. I frequently found that a room had been left undisinfected, or, perhaps, the walls had been done and the floor left untouched, or the ceiling had not been disinfected, and suchlike omissions; parts of the house had been soaked, while the rest was comparatively dry. I also found mistakes in the mixing of the solution.

24,451. Have you got any instance of a place in which plague occurred after it had been disinfected by chemical agencies?—I had one or two cases occurring both in Bulsar and Surat, but I cannot give you the names. A few cases of that sort did occur. It is my general recollection.

24,452. Cases in which houses had not been opened up, but only disinfected?—I will not say that—I think both. They had been both disinfected and opened up.

24,453. Then it seems to tell against both?—Yes, it does. The idea of disinfecting without opening up was not adopted at all in Surat. Dr. Dyson when in Bulsar, as he reported to me, did adopt that arrangement. That is to say, he turned the people out for 24 hours, thoroughly disinfected the house, and put them back again. I have a very strong impression that in those cases plague recurred in some of the houses in which the people were put back.

24,454. Have you got any cases in which houses were thoroughly opened up, and in which no disinfection by chemical agencies had been adopted, in which plague had occurred?—No, I have not noticed any instance of that sort.

24,455. What is the period of time required for disinfection by the free access of air and light?—I have always gone on the principle of at least one month; the more the better, but at least one month.

24,456. What, in your opinion, are the most effective measures in dealing with an epidemic?—In my opinion evacuation, and thorough ventilation of all infected houses for a month, kills plague.

24,457. Do you still agree with the whole of the last paragraph in your précis:—"The towns have been saved "by the introduction of the ward system into them all, "and the villages have been dealt with as in Surat by "prompt and entire evacuation with ventilation (but not "disinfection) of houses. I have discarded disinfection, "because of its expense and uncertainty unless executed "under skilled supervision. In my opinion evacuation "and thorough ventilation of all infected houses for a "month kills plague"?—I stated there that "the towns "have been saved by the introduction of the ward "system into them all." That was true when this was written—as a matter of fact apparently the towns had been saved, but unfortunately, since writing this, plague has broken out in Nasik, Igatpuri, and Sinnar.

24,458. What was your reason for discarding disinfection?—I have discarded disinfection because of its expense and uncertainty unless executed under skilled supervision.

24,459. In connection with your plague measures in Surat, did you undertake any operations to improve sanitation?—We closed several thousand pit privies with fresh earth, allowing the householders to construct open privies over them. These pit privies were in the ground floor of the houses either inside or just outside the house wall. They were cleared at irregular intervals; in some instances they had not been cleared within the memory of the present owner, and were very often in the immediate proximity of a well from which water was taken for drinking. An attempt was also made to clear away a crowded rookery inhabited by Golas (rice pounders) by offering them other sites (free of charge) as well as a certain amount of free building material. The attempt failed, as the Golas refused to move, and the Municipality were too poor to apply the Land Acquisition Act.

24,460. (*Mr. Hewett.*) How many villages were infected?—There a great number of villages infected, especially in Chornsi taluka, round Surat. There were two parts of the district in which a large number of villages were infected. There was the Chornsi taluka round the city of Surat, and part of the Bulsar taluka—that is the south of the Bulsar taluka round the town of Bulsar. That was undoubtedly due to traffic between the villages and the two towns respectively.

24,461. Have you any idea of the number of people who left Surat?—Yes, I made a calculation and I estimated that about 10,000 people had gone away. We had a pass system.

24,462. Those who left went away on passes?—Yes, on passes. A few may have gone before, but the great majority went away on passes.

24,463. You do not think many got away without passes?—No, I do not think so.

24,464. How many villages are infected in the Nasik district?—At present about a dozen including three Municipal towns.

24,465. Have there been a number of villages infected in the district at any time?—From the beginning of this epidemic I suppose there have been 25 towns and villages infected altogether.

(Witness withdrew.)

Lieut. A. N. DAVIDSON, I.S.C., called and examined.

Lieut. A. N. Davidson, I.S.C.

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24,466. (*The President.*) I believe you are occupied with plague work in Nasik?—Yes.

24,467. (*Mr. Hewett.*) How long have you been employed here?—Since the 13th December 1897—roughly, 14 months.

24,468. What is the population of Nasik?—At the beginning it was 24,000 or 25,000.

24,469. When you came here in December, 1897, was there plague in the town?—Yes.

24,470. To what extent?—It averaged eight cases a day. The greatest number that I remember in any one day was 13 cases and deaths.

24,471. Can you give the total number of attacks and mortality in the town up to date?—In the first epidemic there were 501 attacks and 384 deaths, and in the second epidemic 182 attacks and 149 deaths up to date.

24,472. How long did the first epidemic in which there were 501 cases last?—It commenced in October. There had been imported cases in the town previously.

24,473. When did the indigenous cases begin?—In October 1897, plague was declared to be indigenous.

24,474. When did the first epidemic terminate?—The last three cases were in March, 1898.

24,475. In dealing with that epidemic, did you make the people evacuate infected blocks?—Yes.

24,476. How much did you evacuate when you got a case of plague?—When we had a few cases in any block we evacuated the block.

24,477. When you evacuated a block, did you put the people into the segregation camp or did you allow them to go where they liked?—A camp was made and they were told they might occupy it. I should think not 10 families occupied it; they went where they wished.

24,478. Did any proportion of the people leave the town altogether?—A very small proportion. I was employed on plague work in the fields for some time.

24,479. Having got the people out of their houses, did you take measures with respect to the infected locality?—Every house was disinfected with perchloride of mercury.

24,480. How long after the disinfection were the inhabitants allowed to come back to the town?—Two or three months, in my experience.

24,481. Did you allow them all to come back?—The people who were turned out first were Musalmans and Kalals. They were out for some time. They would not come in when they were first allowed to do so, because their clothes had to be disinfected.

24,482. You insisted on the disinfection of the clothes on going out and coming in?—Not on going out; on returning, we did.

24,483. You allowed some of them to return within three months, I believe?—Yes.

24,484. After the close of the epidemic in March, did you have any dropping cases?—There were two cases. There was one case in the Collector's compound and one in the Abkari Inspector's compound. They were friends—one a syce and the other an indoor servant.

24,485. How were they infected?—I do not know.

24,486. Did these cases occur in houses in which there had been already cases of plague?—No; there had been no previous cases. The last case in March occurred in a house in which there had been no previous case.

24,487. Did these cases you refer to occur in March?—Towards the end of March.

24,488. After the end of March, when you considered that the epidemic was over, what interval was there before you had another case of plague?—I think we had an imported case in August or September from Trimbak.

24,489. Is that a town in this district?—Yes, about 18 miles from here.

24,490. What did you do when you got an imported case?—We sent it to the hospital, together with the contacts.

24,491. Did you do any disinfection?—There was no disinfection this year. We opened the doors and windows and took off the roofs and barricaded the doors on the ground floor.

24,492. How long did it take for plague to become indigenous the second time?—We had an occasional imported case until 14th January 1899. Towards the end of January it became indigenous. I received information about two weeks previously that plague was being concealed in a portion of the city which did not belong to me, and I reported that to Mr. Menzies.

24,493. Do you remember whether the population of the city, in the interval between August and January, was above or below normal?—About normal, I think.

24,494. The second epidemic is going on at present?—Yes.

24,495. Have you been proceeding on the same principle of evacuating blocks?—No evacuation has been carried out at all. The people have been advised to leave the city.

24,496. What action do you take when you find a case in a particular house?—We have sent the case to the Plague Hospital and we have all the contacts removed.

24,497. You have done nothing to the house?—Only opened it up.

24,498. Since you have adopted this plan of only opening up the house and not disinfecting it, have you allowed any people to return to the houses so treated?—No.

24,499. So that you have had no opportunity of finding out whether it is an effective way of disinfecting houses?—No. People have been working in the house by day and cleaning the house, and no case has occurred among them. None of the people turned out of their houses have gone back to live in them.

24,500. Even though you had gangs working in the house, would it necessarily follow that the house was free from infection?—No.

24,501. I presume you took special precautions with regard to such gangs?—These were private people turned in by the owners of the houses to clean the houses.

24,502. There have been no bad results to persons so employed?—None yet.

24,503. How long have these gangs of coolies been doing this work?—I have only seen it done in one house.

24,504. How long ago was that?—With regard to the case imported from Ozar, the people were removed from their house; after about six weeks they applied for permission to re-occupy it. I gave them permission, but the house-owner and his family did not go to live in the house. He turned in coolies to clean the house. The house was being repaired when first evacuated, and the work which had been discontinued there was again proceeded with.

24,505. In this particular instance the case that occurred was imported, so that it is quite possible that the house was never infected, is it not?—It is quite possible.

24,506. Have you formed any opinion as to how the second infection took place?—I am of opinion that it was caused by the Kalals who go to the Ghoti Bazar, a badly infected village. I think they brought it from there. They are rice dealers, and deal largely in rice.

24,507. How far off is Ghoti?—About 20 miles, near Igatpuri.

24,508. Have you observed any cases of plague occurring during the second epidemic in houses in which it occurred in the first epidemic?—No, but I know as a fact that five have occurred.

24,509. In those five cases that have occurred, did they occur without the possibility of infection having come from outside?—I do not think it occurred from plague lying dormant in the house.

24,510. Has the great majority of cases which occurred during the second epidemic occurred in houses in which there were not cases in the first epidemic?—Out of 200 cases only five occurred in the houses which had been previously infected.

24,511. Have cases which occurred in the second epidemic occurred mainly in the same quarters as those in which they occurred in the first epidemic, or in

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different quarters?—In the same quarters. It is not my part of the city, but I know it is in the same quarter. It has not spread so rapidly into the town.

24,512. Have you noticed any mortality among rats?—No. I do not suppose I have seen 10 dead rats since I have been here.

24,513. Was there any mortality among rats before you came?—I heard of it.

24,514. You heard that there were dead rats in the first epidemic?—Yes, I heard of it. When I have gone round the city I have always looked for rats, and when I saw a dead one I made inquiries.

24,515. What system have you now got for preventing imported cases coming in without being detected?—The people have been warned, since we have started work in June, that they must report every case of arrival from infected places within six hours, and to the best of my belief we get the majority of these. When these cases are reported I see the new arrivals daily for 10 days. Out of, roughly, 8,000 people that passed through my hands from infected and uninfected places I have only had three imported cases of plague.

24,516. You mean you have seen 8,000 of these arrivals?—I have not seen 8,000, because out of that 8,000 5,000 or 6,000 would be from uninfected places. But out of 2,000 or 3,000 arrivals from infected places I have only had three imported cases of plague.

24,517. Do you find that the people are willing to help you to find cases of plague?—Yes.

24,518. Do you attribute that at all to the fact that they have already been previously harried by plague?—Yes. They are desirous of keeping people from the infected part of the city from going into the part we still believe to be uninfected.

24,519. Do you think they assist you more than they would in a town in which there had been no outbreak of plague?—Yes. I think they recognise that it is to their own good to keep it away from their houses.

24,520. Do you find that ordinary cases of death and sickness are reported here now?—Yes.

24,521. Do they report sickness?—Yes. I get reports of such things as children teething. I am speaking now about my part of the city. My opinions are not the same with regard to the Musalmans' end of the city.

24,522. (*The President.*) What is the quality of the houses in the quarters which you have spoken of as being chiefly infected?—The majority of the houses are dirty and dark.

24,523. That is in contrast with the general condition of the houses in this place?—I think the houses where plague chiefly is are especially dirty.

24,524. I suppose they are all pretty dark in the town?—The majority of the houses are dark, and there is no ventilation.

24,525. Was there any overcrowding, do you think, in these houses?—In some of them I think there was.

(Witness withdrew.)

Mr. G. W. Hatch, I.C.S.

Mr. G. W. HATCH, I.C.S., called and examined.

24,526. (*The President.*) You are the Assistant Collector of the Eastern Division of Khandesh?—Yes.

24,527. (*Mr. Cumine*) I think your experience of plague is confined to the eastern part of Khandesh?—Yes, to the Jalgaon and Bhusawal talukas.

24,528. When did indigenous plague first appear in the Khandesh district?—In November 1897, in Jalgaon.

24,529. Is it known for certain where the infection came from?—There are two stories. One is that it came from Ghoti in the Nasik district, and the other that it came from Sholapur. In both cases Marwaris suffering from plague were supposed to have come and died at Jalgaon.

24,530. It came by human agency?—Yes.

24,531. After the discovery of the first suspected case, did you go and stay at Jalgaon, and watch all the deaths?—Yes, I went and stayed there and watched the deaths.

24,532. Did you mark down on a map* against the houses where they had occurred the deaths that had been occurring throughout the month of November?—Yes. All the deaths in November were marked on the map.

24,533. What is the special lesson that the map seems to teach? Does it seem to show that the noting of the localities where deaths are occurring is even more important than the noting their mere number, for purposes of seeing whether plague is in a town?—The map speaks for itself. There was an excessive mortality during the month of November, and 28 deaths occurred in *this* circle (*pointing on the map*). The average number of deaths for the month in previous years being 33, in November 1897 61 deaths occurred, and the excess (28) occurred in *this* small circle (*pointing on the map*).

24,534. *The President.*) Plague deaths?—We did not know By looking at the map one can see whether the deaths occurred in one locality. The probability is that they were due to plague.

24,535. (*Mr. Cumine.*) How many more villages became gradually infected in Khandesh?—Those I know about were Bholana and Pimpralla.

24,536. What was the total number in the Jalgaon taluka?—The total number was three in the Jalgaon taluka, and seven in the Jamner taluka.

24,537. Did the infection come from Jalgaon in those cases?—Yes.

24,538. There was one village became infected in the Amlaner taluka, I think?—Yes, and one in the Chalisgaon taluka.

24,539. Is it known where the infection came from in those two cases?—No, it is not known.

24,540. In what month did the 1897-98 epidemic cease in Khandesh?—In April 1898.

24,541. Did plague appear again this fair season in Khandesh?—Yes, it broke out in Kanaswadi, village within two miles of one of last year's plague-stricken villages—Bholana.

24,542. Will you give us an account of the outbreak in Kanaswadi?—Kanaswadi is a village of 269 inhabitants, almost entirely Kolis. It is distant about two miles from Bholana, and has little intercourse with other villages besides Bholana. The last case of plague at Bholana occurred on 18th March 1898. In November 1898, indigenous plague occurred at Kanaswadi. At that time there was no plague in Khandesh. There is no history of any case having been imported into Kanaswadi from outside the district, and I cannot consider that such a thing would have been possible. Examination of the death register at Kanaswadi, coupled with enquiry among the people, showed that the first death from plague had probably occurred on 1st October, and the second on the 2nd November. There were no deaths in the village between those dates. There was a story of a girl who had come from Bholana in August or September and who suffered from fever and a swollen face, but who recovered. Enquiries at Bholana showed that the village had been free from plague for the last five months. The accompanying extract from the death register shows this fact clearly enough.

EXTRACT from BHOLANA DEATH REGISTER (from April to December 1898.)

Date.	Person.	Age.	Cause of Death assigned.
April 3rd	A Mahar woman	25 years	Syphilis.
April 4th	A Dhangar child	1 year	——
June 25th	A Koli child	1 day	Bowel complaint.
July 10th	A carpenter	42 years	Paralysis.
July 12th	A Koli child	7 months	Bowel complaint.
August 2nd	A Koli youth	15 years	Bowel complaint.
September 23rd	A Kunali child	1½ month	Accident.
September 25th	A Koli child	1 year	Bowel complaint.
October 26th †	A Vaidu child	1 year	Measles.
November 3rd	A Koli child	18 days	Bowel complaint.
December 4th	A Koli child	3 years	Bowel complaint.
December 6th	A Mahar girl	8 years	Fever.

† In the same house I discovered the girl with buboes on the 8th or 9th December.

* Not published with the Commission's proceedings.

However, on the 6th December, a girl had died at Bholana from fever, and in the same house on the 9th or 10th December I found another girl suffering from fever with buboes in the groin. The girl and her family were segregated; and she got well. No other person in Bholana fell ill during December. I took the census of the whole village several times in order to satisfy myself on this point. Nor has there been any outbreak at Bholana since. To my mind the only explanation of the outbreak at Kanaswadi is that the plague germ was imported from Bholana, that it existed at Bholana, throughout the rains, in a weakened form, and that it became virulent again when it got a fresh habitat at Kanaswadi.

24,543. I believe plague spread, this fair season, to several other villages in the Khandesh district. Do you remember how many, approximately?—I fancy some six or seven. It has come in fresh from Hyderabad.

24,544. Will you put in the figures with reference to the outbreaks with which you are best acquainted, viz., those at Jalgaon, Bholana, Pimpralla, Kanaswadi, and Gozora?—The table is as follows:—

Village.	Population.	Date of First Case.	Date of Last Case.	Total.	
				Cases.	Deaths.
Jalgaon - -	15,000	23 Nov. 1897	23 Feb. 1898 -	115*	102*
Bholana -	800	22 Jan. 1898	18 March 1898	30	23
Pimpralla -	3,100	27 Jan. 1898	19 March 1898	26	22
Kanaswadi -	269	1 Oct. 1898	8 Dec. 1898 -	25	21
Gozora - -	950	30 Nov. 1898	1 Feb. 1899 -	24	22

* To these figures should be added about 40 cases and deaths that occurred during October, November, and 1st week of December, *i.e.*, before there was any organization for discovering and recording cases.

24,545. With regard to evacuation, what are the lessons you think it teaches?—I have noticed three points: the first was, that partial evacuation is useless to stop the spread of plague unless it follows on the early detection of the first imported case. There have been several examples of that in the villages I have seen. In Jalgaon the evacuation of the quarter in which an excessive number of deaths had occurred was found to be useless. In the next few days cases occurred just outside the evacuated area, although we had left a considerable margin. At Bholana, when the village was evacuated, two families, in which were women about to be confined, were allowed to remain in the village. Their houses were distant from the infected quarter. Within the next ten days a case of plague occurred in each family. At Gozora a man died suddenly from fever on the 30th November. A fortnight later I heard that this man was a visitor from Kanaswadi (an infected village). I went to Gozora, disinfected the house in which the man died, and segregated the one person living in it. Fifteen days later, that is on 31st December, a death occurred in the next house; for the next five days a death occurred each day in neighbouring houses. On 7th January I went to Gozora and found a case of plague. Inquiries showed that the six deaths, from 31st December to 5th January, were all probably due to plague. It is noteworthy, that exactly one month elapsed between the death of the imported case and the first indigenous case. Between 30th November and 31st December only one death—of an old man from asthma—occurred in the village. On the other hand, I have seen many cases in which prompt evacuation of a few houses following on the discovery of the imported case has prevented the plague catching hold of the village. In all these cases the contacts were segregated and the houses disinfected within 48 hours of the death of the imported case.

24,546. I believe you have some charts which you wish to put in?—Yes.*

24,547. In the town of Jalgaon, I believe, plague was bad in November, and the town was evacuated at the beginning of December. When did the attacks finally cease?—The last case was on the 28th of February.

24,548. So that the plague took about three months to stop after evacuation?—Yes. We had only six cases throughout February.

24,549. You found that evacuation decreased the mortality?—Yes, it brought it down at once, as the charts* show.

24,550. (*The President.* Do the examples which you have mentioned of total evacuation apply to villages into which plague had only recently been imported?—In Jalgaon plague had been in the village for quite a month before evacuation.

24,551. Could you show us, from the Jalgaon chart,* what the effect of evacuation was?—There were two evacuations. We, at first, left in one-sixth of the town, but turned it out a month later. We left in one detached portion of the town. It did not seem necessary to touch it, as it was right away from the other part. Afterwards, however, we found deaths began to occur in the unevacuated portion, and we turned that out also.

24,552. (*Mr. Cumine.*) What is the population of Jalgaon?—15,000 roughly.

24,553. Is there a large trading community there?—Yes, it is the centre of the cotton trade.

24,554. When you turned all the people out, did you institute a system of passes, and put policemen upon the roads to attempt to prevent the people from leaving Jalgaon without permission?—Yes, that was done.

24,555. Was that successful?—I do not think it was; the people got away as much as they liked.

24,556. Did they carry infection to the other villages in their flight?—They carried it to the Jamner taluka. The place (Jalgaon) was too big to deal with properly: one could not keep an eye on 15,000 people in the fields camped all over the place.

24,557. What do you think is the size of a village you can evacuate so as to keep control upon the people, and stop plague within a few days, and prevent the people running away and infecting other districts?—I should say a village of not more than 2,000—a village where you can take a roll call every day and see that all the inhabitants are there.

24,558. Was taking a roll call found to be specially useful?—I have found it completely effective. Nobody ever ran away. In these other three villages of which I have charts*, Bholana, Kanaswadi and Gozora, I used to go round and take the roll call every morning; I never found a single man missing.

24,559. Were there any merchants or shopkeepers in those villages where the roll call system was successful?—There were a few, just one or two families.

24,560. Do you think, in the black soil of Khandesh, people could be turned out in the heavy rains without causing great hardship to them?—No, I do not think they could.

24,561. One chart* you have put in refers to the village of Bholana. How was it that plague did not stop immediately in that village?—In the case of Bholana the cases that occurred after the people had been out in the fields for a week were all traceable, either to contact with patients in the hospital, or to residence in the village subsequent to the general evacuation. There were two families allowed to stay in the village, and there were people who attended on their friends in the hospital. They were the only people who got plague there after the first week. At Kanaswadi there was not a single case after evacuation.

24,562. Will you describe the way in which you prevented the spread, to other places, of plague from infected villages?—In all the villages, except Jalgaon, a house to house census was taken at the time of evacuation. Subsequently, a daily roll call was called of all the people camped in the fields. No cordon or police guards were required. People knew their roll call would be taken, and they did not attempt to bolt. The result was most satisfactory. Neither Bholana, Pimpralla, Kanaswadi or Gozora became a fresh centre of infection. Bholana and Pimpralla were infected from Jalgaon. I have already given an account of the way in which Kanaswadi became infected. Gozora was infected from Kanaswadi before it became known that plague had broken out at the latter village.

24,563. Are there any particular points connected with the Jalgaon measures to which you wish to draw our attention?—Jalgaon is a large centre of the cotton

* *See* App. No. LXVII. (A) to (D) in this Volume.

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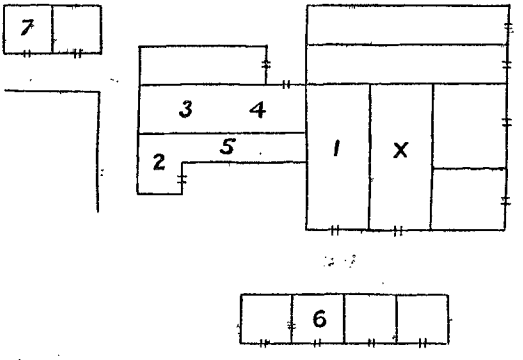
trade; it has a mill employing 1,000 hands and some 20 cotton cleaning and pressing factories. After the first panic on the discovery of the plague it was found possible to carry on the business of the town in spite of evacuation and plague restrictions. A bazar was set up in a field, and the cloth and grain merchants moved their goods and chattels out and opened their shops there and carried on their trade without much inconvenience. The mill put all their employés into camp at the first alarm of plague, with the result that not a single case occurred among them throughout the epidemic.

24,564. I think they had a special doctor for their employés, had they not?—Yes. One noticeable point about evacuation is that it costs nothing at all in these small villages. The people build their huts of karbi (*i.e.*, jowari straw).

24,565. Was there any striking example at Jalgaon of the way in which an influential native can get the people to go out if he leads the way?—Yes, we had several examples of that. It was all done by the influence of two or three native gentlemen.

24,566. When the Patel of the Kunbis went out, did not the whole population of Kunbis follow him?—Yes.

24,567. Do you put in a plan of the infected quarter of Gozora?—Yes, the plan of the infected quarter of Gozora, showing the order in which the deaths occurred, is as follows:—



× marks the house in which the visitor from Kanaswadi died suddenly of "fever" on 30th November 1898.

1 was a Koli girl, aged 5, who died on 31st December 1898.

2 was a Koli boy, aged 11, who died on 1st January 1899.

3 was a Sunar girl, aged 12, who died on 2nd January 1899.

4 was a Sunar woman, aged 41, who died on 3rd January 1899.

5 was a Koli, aged 40, who died on 4th January 1899.

6 was a Koli, aged 18, who died on 5th January 1899.

7 was a Koli girl that I found suffering from plague when I visited the village on 7th January.

24,568. You looked after some villages yourself, did you not?—Yes, Bholana, Gozora and Kanaswadi; I was there all the time.

24,569. What is the number of villages which, you think, one European can, personally, look after efficiently?—If he has to do all the superintendence himself he cannot possibly look after more than two or three, allowing two or three hours' work in each village.

24,570. (*The President.*) Have you adopted any system of disinfection in connection with your operations?—Yes. In all these villages, as soon as the evacuation was complete, the roofs of the houses were opened. In the small villages we took the roofs completely off. The houses were then disinfected with perchloride of mercury.

24,571. How long was it before the people were allowed to return to their houses?—We kept them out until the hot weather, about two months after the last case.

24,572. Have you any examples of any recurrence of plague in houses which had been so treated?—No, not after they were allowed to go back to the villages.

24,573. Are these villages now free from plague?—Yes, I have mentioned the case of Bholana. I found a case at Bholana this year, one case.

24,574. With the exception of that instance, they have all remained free?—With that exception, they have all remained free.

(Witness withdrew.)

(Adjourned till Monday, March 13th, at Bombay.)

At The Secretariat, Bombay.

Monday, 13th March 1899.

SIXTY-FOURTH DAY.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Prof. A. E. WRIGHT, M.D.
Mr. J. P. HEWETT.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. G. MULLANNAH, re-called and further examined.

Mr. G. Mullannah.

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24,575. (*The President.*) You, I think, have some information to give us in regard to experiments made on cotton* ?—Yes.

24,576. Will you be good enough to detail them ?—I received six samples of cotton on the 22nd of January 1899.

24,577. Where did they come from ?—They came from Kopbal.

24,578. Was there anything connected with plague in regard to this cotton ?—The samples were supposed to have been taken from houses where plague cases occurred.

24,579. It occurred in each house ?—Yes.

24,580. How long, before the cotton was taken from each house, had there been plague in the house ?—I do not know that. I took a little bit of cotton from each of these four samples, and inoculated four broth tubes. Next day there was growth of a number of organisms in each tube. I examined the slide preparations from each, and among these four tubes I found one which contained polar staining bacilli. That cotton was from a place called Sampur. On the 23rd of January, therefore, I inoculated the rabbit with a half c.c. of this broth, in which polar stained bacilli were found. The rabbit died on the 25th; it was found dead in the morning about six o'clock when the laboratory was opened. At the *post-mortem* examination, we found that the inguinal and the axillary glands were enlarged, and that the lungs were congested. In the spleen, and in the lung, there were a few polar stained bacilli found, but the gland was full of polar stained bacilli. These polar stained bacilli were of different shapes; some looked like plague, but others were narrower and longer. I have a slide preparation of it here. (*Slide produced and handed in*). I made cultures from gland, blood, spleen, and lungs, but from the gland I had pure growth of cocco bacilli (yellow). From the lungs I got two different kinds of organisms, both polar stained, but one was motile, and the other not. Both, when grown in broth, made the broth cloudy, so I concluded that these organisms were not plague. I then inoculated two more rabbits with these.

24,581. From the original broth ?—No, with the bacilli which were obtained from the lung. The rabbit which was inoculated with the culture of cocco bacillus did not die.

24,582. (*Dr. Ruffer.*) How much did you inoculate ?—Two c.c. Four c.c. of broth was mixed thoroughly with the growth on one agar tube, and, out of that, two c.c. were used. I inoculated two rabbits, Nos. 154 and 155, with non-motile, and motile polar staining bacilli respectively. No. 154 was inoculated on the 4th with 2 c.c., and died on the 17th. The glands were not enlarged, there was no congestion of the lungs, and there were no signs of plague; it only died of septicæmia, and the polar staining bacilli were found in the blood and spleen. Rabbit No. 155 was inoculated on the 4th, and this died on the 12th, of septicæmia. In these animals neither of them had the glands enlarged, nor congestion of the lungs, but the polar stained bacilli were found in both of them. The rabbit inoculated with the cotton was suspicious. There were *post-mortem* signs of plague, but I could not get a growth of bacilli which I could call plague bacilli. The bacilli I cultivated from it were not plague. Probably there were more organisms in the cotton than these bacilli, and perhaps there might have been plague bacilli as well; but I could not give any definite conclusion about that, as I did not get a culture of plague from it.

24,583. The *post-mortem* appearances, and the morphological appearances, were those of plague ?—Yes.

24,584. But the further tests did not confirm you in your opinion ?—No, not in my opinion.

24,585. So that you can draw no accurate conclusion ?—No, personally, I cannot.

24,586. On the whole, therefore, you have not succeeded in finding the bacillus in cotton ?—No.

24,587. Are these all your observations in regard to cotton ?—Yes.

24,588. You also made some experiments in order to test the prophylactic value of Haffkine's prophylactic fluid ?—Yes.†

24,589. Would you kindly narrate these experiments, and the results of them generally ?—Thirty rabbits were inoculated with contaminated Haffkine's fluid; out of these, 20 recovered.

24,590. (*Prof. Wright.*) What does contaminated mean ? Artificially contaminated ?—The fluid, as it is received from Bombay, was examined, and proved to contain septic organisms.

24,591. (*The President.*) A fluid in which you found living organisms ?—Yes.

24,592. You did 30 experiments with the so-called contaminated Haffkine's fluid ?—Thirty-eight; and 30 out of these were subsequently inoculated with plague, from which 20 recovered.

24,593. You first injected this prophylactic, and then there was a certain interval; what was the interval ?—The interval varied; sometimes it was one week, and sometimes it was two months. In one instance there was more than two month's interval.

24,594. You then administered the plague virus by sub-cutaneous injection ?—Yes, generally, but a few cases had a loop-full of pure culture of plague rubbed into a scratch made.

24,595. What was the general result ?—Twenty recovered and 10 died. Among the 10, two died accidentally, and eight died of plague; besides these, from the protective itself, eight died.

24,596. What was the smallest dose of the protective administered in those eight experiments ?—To those which had prophylactic alone, the smallest dose ad-

* *See* App. No. LXVIII. in this Volume.

† *See* App. No. LXIX. in this Volume.

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ministered was 20 c.c. To those eight that died of plague the smallest dose administered was 1 c.c.

24,597. Twenty c.c., in a rabbit of average weight, appeared to kill the rabbit?—Yes, 20 c.c. in a rabbit of the weight of 1,500 grammes.

24,598. Twenty c.c. of protective in a rabbit invariably produced death?—No, in eight only of 38 cases.

24,599. Did you do any other experiments with the protective alone, except these eight? In all your experiments with contaminated protective fluid, did all the animals die?—Not all the animals; only those eight out of 38 cases.

24,600. The other 30 received both virus and protective. How many experiments were done with the protective alone?—Eight experiments were done with the prophylactic alone (if I am allowed to call them so). The eight animals, unfortunately, did not survive the effects of the prophylactic, to be further experimented upon with plague.

24,601. Therefore, all the experiments which you made with the protective alone, resulted in death?—All the 38 rabbits were inoculated with the contaminated protective fluid alone first; out of these, eight died from the effects of the protective. The remaining 30 survivors received subsequent inoculation of plague.

24,602. Now with regard to the re-sterilised fluid?—There were ten rabbits inoculated, and out of these, nine recovered after subsequent inoculation with plague. One died, and this one had a dose of one c.c. only.

24,603. What was the interval of time between the inoculation with Haffkine's fluid, and with the plague virus?—The rabbit, No. 140, for instance, had protective fluid on January the 19th, 1899, one c.c., one dose, and a second dose on January the 21st, 1899, two days afterwards, and it had plague on the 29th, eight days after the second dose.

24,604. Can you tell us what were the intervals of time between the inoculations?—From four days to about a week.

24,605. The interval between the last inoculation of Haffkine's fluid, and the administration of the plague virus, varied between what period of time?—It varied from four days to 14 days. None of the rabbits in this case died from the protective alone.

24,606. How many rabbits did you experiment with?—Ten.

24,607. In what doses?—In doses varying from one c.c. to 20 c.c.

24,608. Therefore, the 20 c.c. of the re-sterilised fluid did not produce death, whereas the 20 c.c. of the non-sterilised so-called contaminated fluid produced death?—Yes, in eight cases out of 38.

24,609. Can you tell us if the dose of virus which you administered was, so far as you were able to ascertain, near the minimum lethal dose, or much in excess of it?—One c.c. is about one and a half loop-full. Some rabbits recovered from one loop-full and some did not. Usually, with one c.c., every one used to die; that is the minimum lethal dose, I found.

24,610. What is the relation between one loop-full, and one c.c.?—One c.c. is equal to one and a half loop-full.

24,611. Therefore one half more than a loop-full was always fatal?—Yes.

24,612. With one loop-full they recovered sometimes?—Yes, but in these experiments, where only one loop-ful was used, the culture was rubbed into a scratch made, and one cannot say how much is really absorbed.

24,613. What experiments did you do with only one loop-full?—Experiments Nos. 72, 73, 74, 76, 77, and 79.

24,614. What was the interval of time between the inoculation of the protective and of the virus in these experiments; were they varying or all the same?—The same, about five days.

24,615. Five days in each case?—Yes.

24,616. And with an interval of five days between the two; what was the minimum quantity of Haffkine's fluid which appeared to save life?—Twenty c.c. was the only dose used in all these experiments.

24,617. Did you do any experiments on the same conditions with less than 20 c.c.?—No, not with one loop-full.

24,618. Twenty c.c. is, relatively speaking, a large quantity?—Yes.

24,619. Do you think very much less would have been successful?—I think so. There are three in the list. 153 with 12½ c.c. and 136 and 137 with 6¼ c.c. each.

24,620. Were there any serious symptoms in those experiments in which 20 c.c. were employed and the animals recovered? Did the animals suffer badly?—The symptoms were serious; the temperature was very high.

24,621. Was there any other serious symptom other than the temperature?—Yes, local symptoms, abscesses, and ulcers.

24,622. Was the animal very ill?—Yes.

24,623. Was it lethargic; was there any paralysis?—There was no paralysis.

24,624. Did it eat its food?—No, it became very weak and reduced in weight, and laid about.

24,625. Therefore 20 c.c. was a great deal too much in excess of the quantity required?—Yes, we found 2 c.c. protected in one case, No. 162, but the fluid was more or less pure, not nearly so contaminated as that of earlier date.

24,626. What experiment did you do with 2 c.c., where the conditions were the same?—Experiments No. 161, 162, 163, and 164.

24,627. What were the conditions of those experiments?—These rabbits were inoculated with 2 c.c. of more or less pure fluid, only one dose, and then after about nine days they were inoculated with one c.c. of plague, and all of them recovered.

24,628. Have you used a smaller quantity?—Yes, we used one c.c., and the animal died.

24,629. Anything between one c.c. and two c.c. is sufficient to prevent death?—I do not know; we have no experiments on this point.

24,630. Assuming that in a rabbit two c.c. is the quantity required, how much would be required for a man, also assuming that the effect is equal in both cases?—About 90 c.c., according to weight, if the power of different constitutions be not taken into consideration.

24,631. Have you any experiments that seem to indicate the duration of the protection?—We have here one experiment to show that the protection lasted for two months.

24,632. What were the conditions of that experiment?—Rabbit No. 71 was inoculated with 20 c.c. on the 19th of November 1898, and it was inoculated with plague on the 21st January 1899.

24,633. What was the interval?—Two months and two days.

24,634. What was the dose of virus?—One c.c.

24,635. The quantity of protective that you found necessary was ten times greater than when the interval was nine days?—Yes, but less fluid might have had the same duration of protection, but we have no experiments on this point.

24,636. Supposing 20 c.c. is required to produce protection for a period of two months in a rabbit, how much would be required for a man?—Ten times 90.

24,637. Have you any experiments that show that less than 20 c.c. would produce protection for less that two months?—No.

24,638. Have you any experiments, to show protection in one month?—No. We have not done any experiments to find out that a certain amount of fluid has a definite duration of protection.

24,639. Have you any experiments excepting the one you have referred to, which indicate the time for which any given quantity will produce protection? In this instance you have an experiment showing protection for two months. Have you any experiments which show protection for either a longer or a shorter time than two months?—There are many of shorter.

24,640. How much shorter; what interval of time?—Only a week or two.

24,641. They were only a week and two months?—The duration varies from five days to two months and few days. No. 111 had a duration of 24 days.

24,642. In what condition was the Haffkine's fluid when you first used to obtain it?—All contaminated.

24,643. Contaminated with what?—With living organisms.

24,644. Organisms of putrefaction?—Yes.

24,645. Did you find that any improvement took place latterly?—Yes.

24,646. In what respect?—Latterly, there were no organisms in some, and others were much purer.

24,647. Was it absolutely pure latterly?—Some bottles were absolutely pure.

24,648. Not all were absolutely pure?—No, not all.

24,649. What effects did you observe from this impure fluid?—Abscesses, ulcers, septic intoxication, and the reactionary fever.

24,650. Did you get death in any instance?—Yes, in eight cases out of thirty-eight, before referred to.

24,651. What kind of symptons?—Toxic.

24,652. Not suggestive of plague toxæmia?—No, septic toxæmia or intoxication.

24,653. What was suggestive in the reactionary fever?—Plague toxines.

24,654. I understand that you yourself, finding that you had living organisms, took some measures to get rid of them?—Yes, under the orders of the Plague Commissioner.

24,655. What did you do?—I heated the fluid for three consecutive days, for a quarter of an hour, at 60 degrees Centigrade.

24,656. What was the result of that treatment?—The fluid became sterile.

24,657. There were no longer any living organisms?—No.

24,658. Did you make experiments at the same time with this fluid alone?—Yes.

24,659. What kind of symptoms did you obtain with it?—We never had abscesses or ulcers, and always had a temperature lower than with the contaminated fluid.

24,660. A lower temperature and no local symptoms?—No local symptoms and no deaths too.

24,661. What was the maximum dose which you injected of the re-sterilised fluid?—Twenty c.c.

24,662. That, again, was a dose which, you have already stated, was generally fatal with the contaminated fluid?—Contaminated fluid was fatal in eight cases out of 38.

24,663. You found that it was not so toxic; what did you find in regard to it protective power?—It had a protective power.

24,664. In an equal or in a less degree?—In one case it was more powerful, because the same dose killed the rabbit in the case of unsterilised. In the sterilised, it saved the animal under equal conditions.

24,665. Was there any increase in protective power?—Certainly in one case, No. 122, compared with 128.

24,666. (*Dr. Ruffer.*) You say in Clause A of your Memorandum* that you inoculated with plague animals protected with re-sterilised Haffkine's fluid, and that nine recovered. Did you inoculate control animals of the same weight at the same time?—Yes.

24,667. What happened to the animals?—The controls died.

24,668. In each case?—Yes.

24,669. After how long;—After three or four days.

24,670. To re-sterilise the fluid, you say you heated it to sixty degrees Centigrade for a quarter of an hour for three consecutive days. How did you ascertain the temperature of the fluid when you heated it?—With a thermometer.

24,671. Where did you put the thermometer?—In the water surrounding the fluid.

24,672. How did you know that the inside of the bottle had reached 60 degrees? It takes some time for the heat to penetrate through the bottle to the fluid inside?—A few minutes were allowed for the heat to penetrate through the bottle to the fluid inside before we began to reckon the required time.

24,673. How long did you keep the bottle in the water?—For a quarter of an hour.

24,674. You think that sterilised it?—Yes. It did sterilise it.

24,675. Did you make any experiments to find out if it was sterilised?—Yes, by inoculating agar tubes with the fluid and no growth occurred in them.

24,676. How much fluid did you take?—Twenty or thirty drops.

24,677. In Class B of your Memorandum,* when did you look for contaminations? Did you look for them at the time you inoculated the fluid into the animals, or some time before?—In some cases it was done before, in others afterwards, whenever we wanted to examine any fluid, but, generally, at the time of inoculation, when the bottles were opened for inoculating purposes, the agar tubes were inoculated with the fluid.

24,678. You think that is a good method?—Yes.

24,679. You say in your remarks*:—"As received by "us originally, Haffkine's fluid was, without exception, "contaminated with organisms of putrefaction"?—Yes.

24,680. How many bottles of Haffkine's fluid did you get originally?—I cannot say the exact numbers offhand, but it was more than 20 dozen.

24,681. Did you make a bacteriological examination of each one of them?—Of each one used in the experiments.

24,682. You say you did not examine every bottle. I want to know how, then, you can say that "without exception" they were all contaminated?—Generally one bottle from each brew was examined, other times two or more from each brew.

24,683. How can you say they were contaminated without exception, if you have not examined every one?—We examined one bottle from each brew.

24,684. You say it was contaminated, without exception, and I want to know how you can say that if you did not examine each bottle?—It means every on without exception, of those that were examined.

24,685. In your statement* you say "When employed "by inoculation in rabbits, animals which are pecu-"liarly resistent to ordinary septic processes." Can you tell me on what evidence you base that statement?—Rabbits are supposed to be immune from septic organisms.

24,686. Why?—It is a generally accepted opinion of scientific men. Our first series of experiments (control) prove it; besides, I have inoculated some rabbits, and have seen them immune; they do not die, they get abscesses, and recover afterwards.

24,687. From what organisms?—Staphylococcus pyogenes aureus and albus.

24,688. How much do you inoculate?—Twenty c.c. of pyogenic cocci in broth.

24,689. Did you inoculate the same quantities in other animals than rabbits?—No.

24,690. How can you say they are peculiarly resistant if you made no comparative experiment; on what do you base that statement?—I know, for certain, that if 20 c.c. of pyogenic cocci be inoculated into a rat, it is quite sure to die. So I did not think it is worth while to do such an experiment.

24,691. How much does a rat weigh?—I do not know.

24,692. A rat would weigh about 200 grammes at most, and a rabbit possibly ten times as much. What do you think reactionary fever is due to?—The toxines of plague.

24,693. Then you do not think it is due to plague itself?—No.

24,694. Did you ever find the plague bacillus in any animal inoculated with the prophylactic alone?—Yes, once.

24,695. Did you find plague bacillus in that animal?—Yes.

24,696. How did you ascertain that the animal died of plague?—From *post-mortem* appearances of plague, and the organisms isolated from that animal proved to

* *See* App. No. LXIX. in this Volume.

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be plague bacilli when further tests were applied to them.

24,697. How long after the inoculation did the animal die?—The rabbit, No. 96, was inoculated on the 14th December, and died on the 20th; it died six days after inoculation.

24,698. Were you experimenting with plague bacilli in your laboratory at that time? Were there any other experiments going on with plague in the laboratory during that week?—No, not at that time nor a week following.

24,699. There had been, surely. I see you inoculated an animal on the 1st of January, and also one on the 12th of December?—The 1st of January is more than two weeks from that date.

24,700. I see you inoculated five animals on the 12th of December?—Yes.

24,701. Was that animal anywhere near the other animals?—No, it was in a separate cage.

24,702. It was in the same room?—Yes.

24,703. Is it possible that it might have been infected from another animal?—No, it was in a separate cage. There were a good many rabbits, and others must have died of plague also.

24,704. A good many did die?—Only those inoculated with plague died of plague.

24,705. You state that one of these animals died of enteritis, in experiment No. 72?—Yes.

24,706. Did you find the plague bacillus in that animal?—No.

24,707. No. 73 died of tetanus; did you find any plague bacilli in that animal?—No.

24,708. Then these animals should be excluded?—Yes.

24,709. Then how did they die of enteritis and tetanus after being inoculated with plague?—The above experiments refer to those animals which had a loop-full of pure plague culture rubbed into the scratch made, and they had open sores.

24,710. How does an animal get tetanus unless you put it into it?—It can catch it naturally, from the cage or from the grass or dust in the cage, without the virus being put into it by somebody.

24,711. Where was the animal inoculated?—In the thigh.

24,712. Where did the symptoms begin?—In the leg.

24,713. That looks as if it came from inoculation?—Not at all, if it came from inoculation it would affect the other animals too.

24,714. It looks like it?—I do not see how it does. The other rabbits would have got tetanus as they were inoculated on the same day and at the same time.

24,715. What animals were inoculated on the same day?—Nos. 72, 73, 74, 76, 77, and 79.

24,716. No. 75 died of toxæmia. What do you mean by toxæmia in that case: what were the symptoms?—There were no organisms to be found in any organ; and we made cultures, and did not get any growth.

24,717. That is a negative thing; what were the positive symptoms you noticed?—Nothing special, except that it was inoculated with toxines of plague.

24,718. On what clinical symptoms did you base your diagnosis of toxæmia? If you make a diagnosis you must have based it on some phenomena observed; what were the phenomena?—The animal was inoculated with toxine, and there were no organisms. The cause of death was not found out. As the result of inoculation the animal became very ill, had a very high temperature, and then died.

24,719. (*Prof. Wright.*) You said one rabbit died of plague after inoculation with Haffkine's prophylactic?—Yes.

24,720. How many cages have you for rabbits in your laboratory?—About 26 or 27.

24,721. Do you think that a rabbit has died of plague in every one of those cages?—No.

24,722. Was it an absolutely new cage?—No, it was a burnt cage. If the animal dies in a cage we burn the cage, and afterwards the same cage is used for fresh rabbits. We have all iron cages, and we put them in the fire and heat them when required, and they are then used again.

24,723. The rabbit was put into a cage of that kind?—Yes.

24,724. I suppose it was in a cage on the floor beside other cages?—Yes; it was raised above the floor. We generally keep the cages on rows of bricks, and so they are raised above the floor.

24,725. Are there other rabbits also on that platform?—Yes, on the same level, but not on continuous platform.

24,726. Can the urine from one rabbit fall into another cage?—No.

24,727. Why not?—It would fall on the ground; it cannot get into another cage. All cages are apart from one another, separated with little spaces. The floor of one cage is not continuous with the other.

24,728. Have any rabbits died from accidental causes in your laboratory?—Yes, some that had open sores died of tetanus.

24,729. You have, every now and then, deaths among your animals in the laboratory, have not you—among the animals that you have not been experimenting upon?—There was only one rabbit that died in that way, and that died, as I have said before, of tetanus.

24,730. You have often other accidental deaths, have not you? It is a common thing in a laboratory to have accidental deaths among the rabbits that you keep in stock?—There are only two here; one died of enteritis and one of tetanus.

24,731. Is it not a common thing, in your opinion, for rabbits to die accidentally—the rabbits that have not been experimented upon?—We had only two cases of such deaths.

24,732. In what period?—Over a period of ten months.

24,733. What do you infer from the fact that that rabbit died; do you infer that there were plague bacilli in that particular bottle?—Yes.

24,734. Had you tested that particular bottle?—It was tested here in this way, by inoculation.

24,735. You did not test it microscopically?—Yes, I did.

24,736. Did you find any organisms?—No. Nothing besides cocci and a few slender bacilli.

24,737. You still believe that the bottle contained plague organisms?—Yes.

24,738. Why?—Because it is not always possible to find them with microscopical examination alone.

24,739. Have you any record of that particular bottle; in your list you have the entry "Contaminated"? Would you tell us what you found in that case?—The organisms isolated from that particular bottle were staphylococcus pyogenes aureus and albus and long slender, non-motile and non-pathogenic bacilli.

24,740. Those you found in that bottle?—Yes.

24,741. How did you find out it was plague? After that rabbit died did you get cultures?—Yes.

24,742. Were they pure cultures of plague?—Yes.

24,743. Were there no other organisms?—No.

24,744. How did you know it to be a pure culture of plague; did you inoculate other animals with it?—Yes.

24,745. Did you get a cultural test?—Yes, and I also inoculated pigeons and fowls.

24,746. Why?—Because it might have been mistaken for fowl cholera, and I inoculated the fowls to see whether fowls could be inoculated with this.

24,747. What control animals did you have for these various experiments?—Healthy rabbits.

24,748. Did you use a control every time you inoculated a series of animals?—Generally one control rabbit; but sometimes we had six.

24,749. Why are these controls not entered on your list?—It is not entered in this list, which was simply a list of particular experiments put together for the information of the Commission; it is entered in the usual records which I have with me now.

24,750. You say that every one of the controls died throughout the whole of your experiments?—Yes, except those inoculated with a loop-full; among those, two controls recovered.

24,751. Why are these controls not entered on your list; is it simply an accidental omission?—They are not entered.

24,752. Did you, in every case, find that heating to 60 degrees three times effectually sterilised the fluid?—Yes, in every case.

24,753. (*The President.*) You have one rabbit in your experiments in which the conditions produced were very suggestive of plague?—Yes.

24,754. Buboes were produced by the culture of the cotton?—Yes.

24,755. Where was the inoculation performed?—In the thigh.

24,756. In the right or left, or both?—We generally do it on the left.

24,757. Do you know where the buboes were in that case?—In both the groins, and in both axillæ.

24,758. Was there any time succession in the appearance of these buboes, or did they appear simultaneously?—I cannot say, as it is not possible even to feel them during life.

24,759. In regard to some questions you were asked in reference to re-sterilization, you have subjected your fluid to a temperature of 60 degrees for a quarter of an hour, three times?—Yes.

24,760. I understand the fluid was contained in a flask, which was plunged into water, the temperature of which you ascertained?—Haffkine's bottles were heated in a metallic vessel containing water.

24,761. How large was that vessel; what was the capacity of it?—Just large enough to hold about ten bottles of Haffkine's fluid.

24,762. What do you mean by the toxines of plague, as distinguished from plague itself?—One is the product of the other. When you say plague, it may mean bacilli; an animal dying from plague bacilli will be a source of infection.

24,763. Plague bacilli, plus toxines?—Yes.

24,764. They are both plague—the toxines as much as the bacilli?—Yes, but the one being a chemical substance can never be infectious, whereas the other, being living, is always infectious.

24,765. (*Prof. Wright.*) Did you choose the six bottles of prophylactic, sent to me, at Calcutta, for testing purposes?—Yes.

24,766. Were those fair samples of the bottles which you had?—Yes.

24,767. You have spoken of two kinds of bottles; you had one earlier series, which were found very contaminated, and one later series, which you found less contaminated?—Yes.

24,768. Were the bottles which you sent to Calcutta taken from the earlier series?—Yes.

24,769. Were all the bottles which you used in your experiments contaminated?—Yes.

24,770. What about the later series of bottles; did you get them after the Commission had left Hyderabad?—Yes, after the Commission had left.

24,771. Did you get a series of different brews then?—We received bottles of different brews on two occasions.

24,772. You found those a great deal less contaminated?—Yes.

24,773. Did you find any of them contaminated?—Yes, some; but less contaminated. One day I examined six bottles; three were contaminated, and three were not contaminated.

24,774. (*The President.*) Do you think that plague has varying degrees of infectiveness?—Yes.

24,775. In the statement of experiments handed in,* it is stated that "Plague is a disease which shows "itself in many forms. In its virulent forms it is "highly infectious, in its mild aspects it is hardly "infectious at all. To make inoculation universally "acceptable what is now wanted is that Haffkine's "fluid shall be made of uniform strength, so that with "a minimum dose the re-actionary fever shall be of "known intensity and protective power, and not under "any circumstances contagious." Have you any evidence in support of the statement that plague is not contagious in some form?—I think every form is contagious.

24,776. Who wrote this statement about plague?—Dr. Lawrie.

24,777. Do you adhere to it?—No, I do not adhere to that.

24,778. Why did you sign it?—It is mentioned, in brackets, that I do not agree with it.

24,779. That refers to a different point from what I have examined you upon. It is a question of contagiousness. I understand you do not adhere to it?—No, I do not adhere to it.

24,780. (*Prof. Wright.*) Did you do all these experiments yourself?—Yes.

24,781. Did Dr. Lawrie take any part in the experimental work?—No he simply ordered me to do it, and supervised it and verified all the results.

24,782. And then he wrote the report?—Yes.

24,783. (*The President.*) Look at experiments Nos. 166 to 173. Are these experiments in which 2 c.c. of the sterilized fluid were injected?—In half of them it was re-sterilized fluid, and in the other half more or less pure.

24,784. When was plague inoculated?—Eleven days afterwards.

24,785. What has been the general results of these experiments?—I do not know the results.

24,786. You have just heard by telegram that Nos. 166 to 173 are all alive?—Yes.

24,787. Therefore, in each case, the 2 c.c. has been successful?—Yes.

24,788. What was the dose of the virus?—One cubic centimetre.

24,789. Do you know of any control experiments made before this series?—Yes.

24,790. The telegram says that they are all dead?—Yes.

24,791. Then there is experiment No. 112. Kindly look at that. How does this differ from the series we have now been speaking about?—In the amount of the dose, and the period of time.

24,792. Is the dose larger or smaller?—Ten times larger.

24,793. The dose of what?—Of Haffkine's contaminated fluid.

24,794. Is there any other difference?—The time.

24,795. What is the difference in time?—No. 112 was inoculated with Haffkine's fluid on the 28th of December 1898.

24,796. It is the interval of time I want to know. What is the interval of time between the two?—Two months and 12 days.

24,797. What was the interval of time in the case of the other experiments?—11 days.

24,798. Was the dose of virus the same?—Yes.

24,799. The result, in experiment No. 112, is that the animal died, but that experiment is in no way comparable with the others in so far as the interval of time was, relatively, an enormous one?—That is so.

24,800. Let us take another experiment, No. 104. I see the doses are the same; was the interval of time the same as in No. 112?—The interval was two months and 24 days.

24,801. That animal died also?—(Note added by witness on correcting proof of his evidence:—It was alive before I left Hyderabad, and now I see it is still alive.)

24,802. It is not at all comparable; it only shows that 20 c.c. was insufficient when the time is so protracted?—That is so.

24,803. (*Dr. Buffar.*) We found, in examining the proof of your evidence which you sent back, that you had added several things to your evidence?—Yes.

24,804. The Commission was of opinion that this could not be allowed, but that if you wished to make any additions now to your former evidence you could do so. Perhaps you will kindly state what additions you intend to make. I find that in Question No. 5221 I asked you, "You made a *post-mortem* examination, what did you find"? and your answer was, "Germs

* *See* App. No. LXIX. in this Volume.

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were found in the blood, spleen and glands." Do you wish to add anything to that?—*Post mortem* signs of plague. The glands were enlarged.

24,805. Anything else?—Hæmorrhagic. Plague germs were found in the blood, spleen, and glands. It died of septicæmia.

24,806. Is that all you wish to say?—Yes.

24,807. At Question No. 5231 I asked you, "Did you grow the microbes in gelatine"? and you answered, "No." At Question No. 5233 I said, "You have no knowledge of how it grows in gelatine"? and you replied, "Yes, I have." Then I asked, "How does it grow"? and you replied, "It does not liquefy the gelatine," and so on. The two things are contradictory?—I thought you asked whether I had grown plague gems in gelatine, so I stated accordingly. I have grown plague germs in gelatine in Berlin, but not in India. There is, therefore, nothing contradictory in these two things.

24,808. So that the second answer refers to the Hyderabad plague microbe. You say you have no knowledge that it grows in gelatine. "It" refers to the microbe you isolated in Hyderabad?—To your Question No. 5231, "Did you grow the microbes in gelatine"? my reply was, "No." To your Question No. 5233, "Do you know how the plague germs grow in gelatine"? I replied, "Yes, I have, but not here." Here I had not mentioned the name of the place (Berlin) where I did grow plague germs in gelatine.

24,809. But you do not know how the Hyderabad microbe grows in gelatine?—No. I have not cultivated plague germs isolated in Hyderabad on gelatine on account of heat.

24,810. Then at Question No. 5247 I ask you, "What "is the morphological difference between the bacillus "you found and these other bacilli, the bacillus of "fowl cholera, for instance?" and your reply was, "They resemble one another." Is there anything you wish to add to that?—There is little or no morphological difference under the microscope.

24,811. I said, "What is the morphological difference "between the bacillus found and these other bacilli, "the bacillus of fowl cholera, for instance?" and you answered, "They resemble one another"?—They resemble one another except in the involution forms. If you find peculiar characteristic involution forms of plague there is a difference.

24,812. I asked, "What is the morphological dif-"ference between the bacillus found and those other "bacilli, the bacillus of fowl cholera, for instance." Your answer was, "They resemble one another." Do you wish to add anything to that answer?—Yes. It differs in the involution forms. The plague has particular involution forms.

24,813. You are referring here to the bacillus which you found in the earth?—Yes, that has the same peculiar involution forms as the plague germs of Bombay.

24,814. In answer to my Question No. 5252, you simply say, "By Gram solution." Is there anything else you wish to add to that?—By means of Gram's solution, its characteristic growth in broth, and in broth and ghee, its invisible growth on potato, characteristic involution forms, its very, very feeble or non-motility, and the effects of inoculation on different animals.

24,815. Then, in Question No. 5260 I say, "How is this a 'control experiment' of No. 1"? Is there anything you wish to add to your answer?—The word "control" is really wrong; it is not scientific. These experiments were done only to the mere suggestions; they were controlled to the suggestions made by Dr. Lawrie and others as to the effects on rabbits of septic or other fluids.

24,816. At Question No. 5266 I ask you, "How can 'sterile pus' be described as a 'putrid substance'"? and your answer is, "Our object was simply to note "the effects of inoculation of pus directly from a liver "abscess." Do you wish to add anything to that?—Sterile pus was never described as a putrid substance. I received pus from a liver abscess, but I did not know if the pus contained organisms or not. I found afterwards that there were no organisms in it, so it was put as "sterile pus." The object of inoculation was only for various suggestions, whether you get septicæmia from these substances, and then to see the difference between the bacillus which produces septicæmia, and the bacillus of plague.

24,817. The same addition would do for Questions Nos. 5269 and 5270?—Yes. They were all "control experiments" in that sense.

24,818. Then, at Question No. 5283, I ask you, "Why is your bacillus not the pneumo-coccus"? and you answer, "There are great differences. First of all, the mor-"phology; the pneumo-coccus is a large bacillus. "One can see it at once." Do you wish to add anything to that?—The shape and size of the pneumo-coccus, its capsule, its growth in different media, and the effects of inoculation into different animals.

24,819. At the last I see I gave it up, and I said, "I give it up. I cannot find who is responsible for it." At the time you made no answer to the question?—I have already given the answer before, that I am not responsible for the statement, but I am only responsible for the experiments.

24,820. (*Prof. Wright.*) We have before us a letter from Colonel Lawrie with regard to the finding of plague in cotton.* Did you make the experiments upon which that letter was based?—It referred to the experiments I made.

24,821. Will you please answer my question in the form I put it; did you make the experiments upon which that letter was based? We have a letter from Colonel Lawrie stating that the plague bacillus was found in a sample of cotton sent in for examination by Mr. Stevens. Did you make the experiments upon which that statement was based?—Yes.

24,822. Did anybody else assist you in making these experiments?—No.

24,823. Colonel Lawrie's report is based exclusively upon your experience on this subject?—Yes, but he himself also examined the animals, cultures, and preparations.

24,824. I see you say that the samples were received on the 22nd instant; how many samples were there?—Six.

24,825. Then you say, "Cultures were made in broth from these samples on that day"?—Yes.

24,826. "On the 23rd the broth cultures became cloudy and contained growths"?—Yes.

24,827. Does that mean that you inoculated six broth tubes and all were cloudy?—No; I took only four out of the six samples. I inoculated four broth tubes. The next day we found organisms in all; but one tube contained polar staining bacilli.

24,828. You received six samples, and your experiments were carried out with four?—Yes, on that date.

24,829. In the case of each of these four samples you inoculated one tube of broth?—Yes.

24,830. How were these samples of cotton introduced into the broth; were they received in a bottle?—No; they were in parcels; in envelopes.

24,831. Then there were no precautions taken in shutting them up inside those envelopes?—These envelopes were shut up in a tin case.

24,832. What happened? Did you tear open the envelopes?—Yes, with bacteriological precautions.

24,833. Then you put a piece of cotton into a tube?—Yes.

24,834. And the next day you found all four tubes contained organisms; all were cloudy?—Yes.

24,835. Did you examine the contents of each of these tubes?—Yes.

24,836. And in one you found polar stained bacilli?—Yes.

24,837. You paid no attention to the other three samples?—No.

24,838. You proceeded to inoculate that one?—Yes.

24,839. What happened?—The rabbit had a temperature of 104° and afterwards 105°.

24,840. At 2 p.m. that day three rabbits were inoculated with ½, 1, and 2 c.c. respectively, of broth culture; is that so?—Yes.

24,841. You inoculated three rabbits?—Yes.

* See App. No. LXVIII. in this Volume.

24,842. Those rabbits were not new rabbits; they were rabbits which had been previously used, were they not?—Yes.

24,843. Why did you choose rabbits that had been used for previous experiments?—We had no other rabbits; we had no supply of rabbits.

24,844. Therefore, you had to take rabbits which had been previously used for experiments with Haffkine's prophylactic. It says here, that, at 2 o'clock on the 23rd instant, three rabbits, which had been inoculated with culture organisms found in Haffkine's fluid, were taken; those were inoculated?—Yes.

24,845. You did not use new rabbits, because you had no new rabbits?—The rabbits used were not inoculated with Haffkine's fluid itself, but with the organisms isolated from it, and which produced no effects.

24,846. Did one of these rabbits die?—Yes, No. 143.

24,847. It says here that these rabbits were inoculated with ½, 1, and 2 c.c.'s respectively?—Yes.

24,848. The temperature of the first rabbit rose to 105°?—Yes.

24,849. That was the rabbit that had ½ c.c.?—Yes.

24,850. What happened to the rabbits that had 1 c.c., and 2 c.c.?—There was no rise of temperature and they did not die.

24,851. There was no rise in the temperature?—No.

24,852. Supposing you have plague bacillus in a culture, and you give one rabbit ½ c.c., another 1 c.c., and another 2 c.c., which rabbit would you expect to get a high temperature, the one that received the small dose of plague or the one which received the large dose of plague?—One expects higher temperature in an animal which had a larger dose. But the facts here were not so.

24,853. When you made a *post mortem* of the rabbit that had the small dose, you came to the conclusion that it had died of plague?—*Post mortem* appearances were like plague. The glands were enlarged, and there was congestion of the lungs.

24,854. Taking the glands first, have you not constantly found that when you inoculate rabbits with any septic micro-organisms they get enlarged glands?—Only one gland, near the seat of inoculation; I never found all the glands of the body enlarged.

24,855. How large were these glands all over the body?—They were six or eight times the normal size.

24,856. How large altogether, the size of a lentil?—Yes.

24,857. Would that, of itself, have led you to suspect that the rabbit died of plague?—No, there was the condition of the lungs.

24,858. What did you find in the lungs?—There was congestion of the lungs.

24,859. Have you found congestion of the lungs only in plague?—In other diseases too.

24,860. Did the *post mortem* give you any reason to suppose that this was plague?—The organisms resembled plague.

24,861. That is another matter. Apart from microscopic observation, would you have been able to tell that that rabbit died of plague?—Those two characteristic signs were very suggestive of it.

24,862. Those seemed so strong that you think the rabbit died of plague?—Yes, I thought so.

24,863. You have never seen those independently?—I have never seen all these signs together.

24,864. Then you examined under the microscope and found bacteria which you took to be plague?—Yes, they looked like plague bacilli.

24,865. What did you stain them with?—With gentian violet.

24,866. You found bi-polar staining?—Yes.

24,867. Did you come to the conclusion that they were plague bacilli?—I wanted to get a culture of those organisms, and then to see whether they behave like plague or respond to similar tests.

24,868. Did you communicate the fact that you had found this to Dr. Lawrie?—I told him I had found bacilli like plague.

24,869. And did Dr. Lawrie say that they were plague bacilli?—Yes.

24,870. Did he inform the Government that plague bacilli were found?—I think so.

24,871. Were you a party to that; are you responsible for it?—I am not responsible for it, and I was not a party to it.

24,872. Did you authorise Dr. Lawrie to state that?—Dr. Lawrie made the statement on his own authority. I asked him to wait for a few days in order that I, myself, might be sure whether it was plague or not.

24,873. You were not willing to say straight off that those bacilli were plague?—No.

24,874. When you further investigated the matter, did these bacteria turn out to be plague bacilli?—No, not in my opinion, but in Dr. Lawrie's opinion they were.

24,875. You were satisfied that they were not plague bacilli?—Yes, the organisms isolated were not plague.

24,876. You think the report was really based upon insufficient evidence?—Yes, I think so, but Dr. Lawrie does not.

24,877. And your opinion, now, is that there was no plague in the cotton?—I cannot give any definite opinion about that. I could not get any plague germs separated.

24,878. Inasmuch as only the rabbit that got the least of this germ died, do you think it is probable that there was plague in this cotton?—I think it is probable that it contained plague germs.

24,879. You said a minute ago that the germs you found were not plague?—I said the germs isolated were not plague. But it is also possible that there might have been plague germs which I could not isolate on account of rapid growth of other organisms.

24,880. There may be plague germs anywhere, but have you any reason to suppose there were plague germs there?—In that particular case *post mortem* appearances were very suggestive of them.

24,881. You had no reason, from microscopical examination, to conclude these were plague germs then?—No; I inoculated two more rabbits with these organisms which I separated, but they did not produce the same symptoms, *i.e*, the enlargement of the glands and congestion of the lungs. Hence it shows that the organisms which produced these changes were not isolated.

24,882. Your conclusion is, that you did not get plague bacilli out of those rabbits?—Yes, from that rabbit.

24,883. You do not think there is any experimental evidence to show that cotton does carry infection?—There is no experimental evidence.

24,884. Do you not think that, if the bacteria which you grew had been plague, you might have expected to find the other two rabbits dead which received larger quantities?—Yes, but in a broth tube you generally get clumps of bacteria clinging on to one place, and it is possible also that you might get all the bacilli of one kind in half a cubic centimètre. You will always find in a broth tube that the organisms are not distributed evenly.

24,885. Where are the bacteria distributed in a broth tube, at the top or bottom?—The bottom generally.

24,886. It was the first rabbit that got the stuff from the top which died, while the one that got the stuff from the bottom survived. If it had been well mixed up they would all have had an equal quantity of plague?—Even if you shook the tube well up, I do not think it would be possible to distribute all the organisms evenly, unless the shaking up is kept up for some time.

24,887. Was the control experiment made with ordinary cotton?—Yes.

24,888. How was the control experiment made, was that piece of cotton put into broth?—Yes.

24,889. Did you make a plate cultivation from it?—No.

24,890. How are you able to say that there were no such organisms present?—I examined slide preparations and there were none of those bacilli.

24,891. Do you not think there might have been, but that they were over-grown by the other contaminations?

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—It is possible that it might contain polar staining bacilli other than plague.

24,892. (*The President.*) The Commission wishes to ask you two questions with regard to your experiments with cotton. The first is, did you inform Dr. Lawrie that you had not been able to find the plague bacillus in a sample of cotton examined by you?—Yes.

24,893. The second is, when the statement had been published in the press that you had isolated the plague bacillus from raw cotton, did you contradict it verbally or in writing?—Verbally.

24,894. To whom did you contradict it?—Dr. Lawrie. I gave my opinion to him but he differed from it, and still maintains his original opinion.

(Witness withdrew.)

Capt. C. A. Johnston, I.M.S.

Captain C. A. JOHNSTON, I.M.S., recalled, and further examined.

24,895. (*The President.*) We want to ask you some further questions, especially with reference to the statement* you have last sent in?—Certainly.

24,896. (*Prof. Wright.*) You made these experiments, reported by you in this statement with regard to the sterility of Professor Haffkine's prophylactic?—Yes.

24,897. Are these experiments the same as you did when the Commission was at Hyderabad?—Yes, in continuation of the experiments that were done about the 20th of December.

24,898. They refer to the examination of seven bottles of prophylactic chosen at random out of the stock in the Hyderabad laboratory?—Yes.

24,899. I think, when the Commission was at Hyderabad, you brought up six of these seven tubes, shewing obvious contamination?—Yes, and the seventh was doubtful.

24,900. Did the seventh show a slight growth?—Yes, a very slight growth of staphylo-cocci.

24,901. Did you proceed with the examination of the organisms which grew in those tubes?—I separated all the cultures and tried to isolate them as much as I could. I examined them microscopically, and also passed the different bacilli isolated through rabbits.

24,902. Were any two of the bottles you examined bottles belonging to the same brew? No; I do not think any of them were of the same brew, they were all different brews.

24,903. Your experiments did not enable you to judge whether micro-organisms were present in the prophylactic before it was bottled or whether they were introduced in the course of bottling?—I could not say how the contamination did take place, but I suspect that it took place during the process of bottling.

24,904. I presume you could get evidence of that if you examined two different bottles of the same brew, and found micro-organisms in them?—Yes.

24,905. Have you done that?—Yes, I have done it, but not for the Commission.

24,906. Would you tell us about the experiments which you made?—From one brew two different bottles were taken, and two different sets of micro-organisms were found, one bottle contains only cocci, the other bacilli as well as cocci. They were nocuous, but they were not violently pathogenic so as to produce death, except in one case in a rabbit.

24,907. As there were different micro-organisms in different bottles do you draw the inference that the bacteria were not carried through, but that they are introduced into the bottle?—Yes.

24,908. With regard to the micro-organisms that you did isolate, were you able to recognise or name any of them?—No, but I think bacillus mesentericus fuscus and vulgatus was one.

24,909. Did you investigate the micro-organisms which you found with regard to their pathogonic power upon animals?—I did. I passed every one of them into a rabbit, and in some cases through birds, fowls, and pigeons.

24,910. When you inoculated the rabbits with these micro-organisms after you had isolated them, did you inoculate them from pure cultures?—Yes.

24,911. Did you use any large quantities when you inoculated them?—No, not very large quantities.

24,912. Could you give us an idea?—The growth as it is grown, finally separated out in the agar tube, was scraped off and put into from two to four c.c. of broth, and that we inoculated.

24,913. The whole tube full?—As much as could be got off.

24,914. The bacteria inoculated would be enormously more numerous than the bacteria that could be inoculated along with the prophylactic?—Yes. They were not virulently pathogenic organisms, except in one case in which the rabbit was killed. 5338 was the number of the brew that was virulently pathogenic. The sub-culture showed bacilli irregular in size and form, some were thin and others were thick. They were not pure. It was not all one kind of bacillus. I think there was more than one form of bacillus in the growth when I inoculated.

24,915. In your inoculation experiments with these contaminated micro-organisms it happened that one rabbit died?—Yes.

24,916. That rabbit had been inoculated with a mixed cultivation?—Yes; I think it was a mixed cultivation with mixed bacilli.

24,917. You made some experiments with Haffkine's prophylactic fluid after the fluid had been submitted to a process of re-sterilization?—I did not make any myself personally, but I suggested that they ought to be made. I could not be present myself, because I was in camp for the whole week. Before I went out I asked them to do it. They were carried out, and I used to go there two or three times a week to see how they were getting on. As far as I could judge, there was a distinct difference between inoculating rabbits with the re-sterilized Haffkine's prophylactic fluid and inoculating them with the ordinary fluid received from Bombay.

24,918. You mean that the rabbits which were inoculated with the re-sterilised fluid had much less reaction?—Yes, distinctly so, in most cases.

24,919. Were these rabbits afterwards tested to see whether the protection given by the sterilized fluid was as good as that given by the contaminated fluid?—I should say it was even better.

24,920. I suppose you anticipate that in man the symptoms would be less severe?—Distinctly less severe.

24,921. Have you made any experiments by inoculating men with the re-sterilized fluid?—No, I have not had the chance of doing that. I should think the results would be very much better, from what I have seen of the inoculation fluid.

24,922. (*Mr. Hewett.*) Did you have anything to do with the experiments made regarding the existence of the plague bacillus in cotton?—I had nothing to do with them as regards finding the bacillus, but I was asked to see some of the organisms got from it. I suggested that broth should be used to see if there were any germs, plague or otherwise, in the cotton.

24,923. Did you see the results?—I saw the result of the case, which was quoted as one of plague.

24,924. What is your opinion?—I do not think it was plague myself. I said that, before it could be stated to be plague, we wanted more corroborative evidence.

24,925. To whom did you say that?—To Dr. Mullanah. I do not think Dr. Lawrie was present when I said that.

24,926. (*The President.*) I understand your general view is that it is better to have the prophylactic fluid re-sterilized?—Yes, if it is contaminated I think it is very much better to have it re-sterilized. It does not seem to produce any deleterious effect on the fluid itself from the preventive inoculation point of view.

* *See* App. No. LXX. in this Volume.

24,927. In so far as the specimens which came under your own observations are concerned, would it be better if the fluid were re-sterilized?—Yes, but recently I have examined two or three bottles which were received this month or last month, and I find that there are no growths at all in them; they show no contamination.

24,928. (*Prof. Wright.*) Did you find that in every case the process of heating the prophylactic to a temperature of 60° C. three times was effectual in sterilizing it?—Yes.

24,929. Were any considerable number of re-sterilized bottles examined?—About ten.

24,930. Do you know whether there were any spore-bearing organisms?—In the ones I did there seemed to be spore-bearing organisms in one brew.

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24,931. Even those were effectively sterilized?—Yes. I think the spore-bearing organism is the bacillus mesentericus.

24,932. (*The President.*) Is there anything else which you desire to bring to the notice of the Commission?—May I draw attention to one question which I asked myself when I saw the paper about the case which died of tetanus. I said at the time, that it was very odd to get a death from tetanus from inoculation for plague. I should like to say that these loops-full were not done by hypodermic injection at all: they were scratch inoculations. The fur was taken off the animals, the surface was abraded, and it was rubbed on. I advised them to exclude that altogether.

24,933. In that case the whole loop-full was not introduced into the animal?—No, it was not done by hypodermic injection at all.

(Witness withdrew.)

Dr. DINSHAH PESTANJI GHADIALI called and examined.

Dr. Dinshah Pestanji Ghadiali.

24,934. (*The President.*) What are your medical qualifications?—I am a graduate of the Independent Medical College, Illinois.

24,935. Will you put in the statement which you have sent to us as your evidence before the Commission?—It is as follows:—

I have the honour to set forward my views regarding the plague and shall appear before the Commission with pleasure if so necessary.

I hold that the plague is not an outburst owing its cause to a particular microbe or microbes only, but is the effect of an unhealthy condition of various elements; that the elements concerned in the present case are bad water, foul gases, and want of light; the unhealthiness of the soil also comes under the same category; that bad food (traceable to poverty) is also an aggravator of the disease, distinctly proved by the poor succumbing in large numbers; the same result indicates the necessity of proper well-lighted and ventilated habitations for the low classes of people; that the unsatisfactory drainage of the city is one of the great causes of the evil, owing to the large quantities of foul gases emitted and the saturation of the soil by the leakage of faulty pipes, &c.; the soil of Bombay, Surat and other places indicates these defects very clearly; that the injudicious opening up of such drains results in the disease breaking out in otherwise unaffected localities, as proved by the primary ravages at Modi Bay; that the mice serve only as a semaphore of the presence of foul gases and not as the spreader of the evil; that the increased havoc now distinctly indicates that the plague is merely a child of other causes more powerful than the simple so-called microbe; that the systems of so-called disinfection by various fluids do more harm than good; they merely substitute one foul odour for another; that the best way the process of real disinfection can be carried on is by means of oxygen gas; it will improve the atmospheric conditions as well as serve as an exhilarator; that the reason of the mortality being greater among the youthful and the growing is traceable to the prevalence of social vices, *e.g.*, self-pollution; this cause may be said to require paramount attention; that the disease requires attention not as a plague, but as the precursor or indicator of unhealthy conditions of the elements before named; that the segregation of people to open places without comfort or protection from the weather is just as harmful as the dreaded fever itself, for, in people unaccustomed to such rigour, it is liable to produce rheumatism, bronchial inflammations and so on; that the only means to fight the disease are good and thorough sanitation and the elevation of the mental tone of the people by cheerful measures; that the inoculation by M. Haffkine's serum had better be avoided; it is fully poisoning a person to ward off the effects of poison; also the theory of its action is based upon unknown principles; no statistics have been put forward to indicate clearly the total killing of the so-called germs and their non-resuscitation in the human body.

(Witness withdrew.)

Mr. P. B. DANTRA, called and examined.

Mr. P. B. Dantra.

(Evidence translated.)

24,936. (*The President.*) What is your occupation?—I am an estate broker.

24,937. Have you had any direct connection with plague operations?—I am a member of one of the Voluntary Plague Committees, of C. Ward.

24,938. You have volunteered to give us evidence?—Yes.

24,939. What opinion have you arrived at as to the origin of plague?—I think it is caused by the drains and night-soil.

24,940. The drains and night-soil have been in their present condition long before the plague came here, have they not?—There were complaints about the drain since it was made.

24,941. When was the drain made?—In 1881.

24,942. How do you explain the fact that plague did not commence sooner after 1881 than 1896?—The work of constructing the main drain was taken in hand in 1881. The population also began to increase, and the sullage also began to accumulate in the drain.

24,943. What is it that proceeds from this accumulation which causes plague?—The sullage and night-soil accumulating in the drain. In 1896 there was no rain for the last two months of the monsoon, and the night-soil and other sullage accumulating in the drain gave rise to the plague.

24,944. Do you mean that the accumulation polluted the air?—I am not a professional man, and I am not able to answer that question, I request you to read my précis of evidence.

24,945. I have read it. You have made some proposal as to the best measures to adopt; what do you think is the best measure?—Instead of the night-soil getting into the drain, it should be taken a long distance out to sea and thrown there, as is done in Hong Kong.

24,946. Do you believe in the efficacy of bonfires?—The bad effluvia coming from the gutters may perhaps be removed by the burning of bonfires.

24,947. It is the effluvia of the sewage which, in your opinion, is the cause of plague; is that so?—The exhalations coming from the gutters are the cause of plague, and the rats coming out of the gutters are another cause of plague.

24,948. The bonfires are intended to destroy the plague in the air?—Yes.

24,949. Are these effluvia being continually given off, or only at certain times?—The effluvium continues coming out always.

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24,950. Do you propose that bonfires should always be burning?—The burning of bonfires at one place or at several places at one time will not be sufficient.

24,951. Then it requires continuous bonfires?—Wherever it is found that the atmosphere of a certain district is contaminated, the bonfires should be continued there for some time every evening.

24,952. Suppose the effluvia are bad in the daytime, should there be no bonfires to destroy the plague then?—In the morning and afternoon there are the rays of the sun; in the evening there are no rays of the sun, and bonfires should be burnt in the evening, as I do in my own street.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

SIXTY-FIFTH DAY.

Tuesday, 14th March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Col. D. Robertson, I.S.C.

14 Mar. 1899.

Colonel D. ROBERTSON, I.S.C., recalled and further examined.

24,953. (*Mr. Hewett.*) Since you were before us last, you have had a considerable outbreak of plague in the Mysore city?—Yes, an outbreak commenced very shortly after, and is still continuing.

24,954. What is the population of the city of Mysore?—Seventy thousand.

24,955. Has the epidemic been severe there?—Yes, it has been severe; the total mortality, I think, had reached 57 or 58 per diem.

24,956. What system has the Darbar of the Mysore State adopted as regards the people sick of plague in Mysore town?—The system adopted in the Mysore city has been throughout the voluntary system, as opposed to the forcible system which we tried and worked so unsuccessfully in the Bangalore Civil and Military Station. The system, briefly, is the adoption of all the safeguards, or the measures that were considered necessary under the forcible system, with the exception that everything is left to the people themselves, that is to say, the acceptance of these measures is left to the people.

24,957. Do the people report cases of sickness?—The reporting is surprisingly accurate in Mysore as regards the death-rate; I am not sure about sickness; but every case of death is reported, and before interment or burning takes place a certificate is obtained from the Ward Officer.

24,958. And have you means of ascertaining that the reports of deaths are practically accurate?—I have personally satisfied myself that the reports of death are accurate, for the reason that they are prepared independently by two branches of the city administration, and they do not always agree. There is a variation of one or two, which is, in itself, a sign of honest attempt to prepare a correct total. I think there is no question about it that the reporting of deaths is accurate.

24,959. When a case of plague is reported in the Mysore city, how is the patient treated?—The house would be at once marked as infected, and the people would be urged to take the sufferer to the hospital and to vacate the house as soon as possible, in order that it might be disinfected.

24,960. Do you know whether, in the majority of cases, the people prefer to take the patient to hospital, or to treat him in his own house?—In the majority of cases they treat him in their own houses. I may mention that the State has provided men with English qualifications who go about the city and afford medical relief gratis wherever it is acceptable, but in the majority of cases the people prefer to treat the patient in their own houses

24,961. When the relatives of the patient elect that he should be treated in his own house, what is done with the other inhabitants of the house?—They are allowed to remain there.

24,962. And permitted to have free access to the patient?—Yes.

24,963. Is any attempt made to isolate the patient in one particular portion of the house?—I believe not. At one time they professed to isolate the patient, and, indeed, to turn out the people in the infected house, but after a time it was found that the attempt was hopelessly impracticable, and it was dropped, and practically now the people are left to themselves.

24,964. Between the interval of the reporting of a case of plague and the death or recovery of a patient in his own house, is any attempt made to disinfect the house?—Yes, unless the patient is practically *in extremis*, they would move him out, and disinfect the house, and put the man and his surroundings back again.

24,965. Is there any subsequent system of daily disinfection of the house?—No.

24,966. Does the patient as a rule in Mysore sleep on the floor or on a bed?—The invariable custom in Mysore, I think, is for the people to sleep on the floor.

24,967. When you gave us evidence as regards Bangalore, you told us that the attitude of the people had been anything but helpful. Do you consider that the attitude of the people in Mysore has been helpful?—I think the attitude of the people in Mysore has decidedly been helpful. This effect may partly have been contributed to by the manner in which the Seringapatam town riots were dealt with by the Darbar. The forcible measures adopted by the Darbar undoubtedly tended towards a more pacific attitude on the part of the people. I may mention that the Darbar was very apprehensive of the advent of plague in Mysore, so much so that they requested that volunteers might always be kept ready to turn out at any moment should occasion be required. Mysore containing a considerable Muhammadan population, the Darbar feared outbursts of turbulence amongst them, but up to the present time I am glad to say that these apprehensions have been entirely falsified.

24,968. Have you had many instances in which dead bodies have been thrown out in the Mysore city, as at Bangalore and in the Civil and Military Station?—I have not heard of one.

24,969. Then may it be assumed that whatever the other effects of the measure adopted in Mysore city are, it has been more successful in detecting cases of plague in the houses in which they have occurred?—Certainly.

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24,970. Have you been able to observe how the system adopted in Mysore has affected the spread of plague in particular portions of the town?—One very marked feature of the outbreak in Mysore has been the slow manner in which it marched within the town; that is to say, it stuck to one particular district or muhalla of the town, and it did not, as it did in Bangalore Civil and Military Station, jump from one part to the other. The movement has been very slow.

24,971. To what do you attribute that?—I think the cause may fairly be attributed to the fact that the people do not bolt from apprehensions of segregation, but they remain in their houses. There is no terrifying cause, or influence, which would induce them to bolt from one part to the other.

24,972. Have you been able to compare the manner in which the country-side in the neighbourhood of Mysore city has been effected by plague, as compared with the country-side in the neighbourhood of Bangalore city and Bangalore Civil and Military Station?—On this point, my information is necessarily derived from the Darbar, but the authorities—and I believe their reports are fairly accurate—assure me that the country round the Mysore city is very little infected as compared with the country around Bangalore.

24,973. I understand you to say that in both cases the reports come from Darbar?—In both cases, certainly.

24,974. So that there would be the same element of error?—Yes, certainly.

24,975. Do you think that the fact that the neighbourhood of Mysore has been less infected than the neighbourhood of Bangalore could be accounted for by the fact that the villagers now know about plague, and keep strangers out of their villages?—Yes, I think that may have something to do with it, and it is also possible that people may have camped out more than they could in the time of the Bangalore epidemic, when we had almost continuous rain.

24,976. But you would not exclude the possibility of benefit having resulted from fewer people having left Mysore?—I think that is the main cause.

24,977. Could you give us an estimate of the number of people that left Mysore?—I believe it is impossible to do that, because no census was taken of Mysore at the commencement of the plague, and the ward registration of the inhabitants was very defective. They do not know themselves, but looking at the town as I have frequently seen it of late, it did not strike me that it had emptied to any appreciable extent.

24,978. Was there any panic, or any serious disturbance of the ordinary business of the people in Mysore?—There was no panic and no disturbance whatever.

24,979. Was there any disturbance of business in Bangalore city?—Most decidedly. The food supplies ran out almost entirely, so much so that grain was almost selling at famine rates, and we had, for the Civil and Military Station at all events, to improvise an agency for importing grain and firewood, and foodstuffs for the people.

24,980. Are you of opinion that it is not possible, at the present moment, to pronounce authoritatively on the relative merits of the systems adopted in Bangalore and Mysore respectively?—That is so, but at the same time I think there can be no question that the evidence, so far as it is available, points unmistakably in favour of the Mysore voluntary system.

24,981. Would you, as the time goes on, send us reports as to the progress?—Certainly. I may mention that Mr. Cadell is my Assistant, and he has various figures to give, and anything we can supply we will.

24,982. (*Dr. Ruffer.*) Are the sanitary conditions in Mysore the same as in Bangalore?—If anything, the sanitary conditions in Mysore are worse than in Bangalore.

24,983. You mean that the people are more crowded together?—I think the town stands lower, it is more waterlogged, and it is an older city.

24,984. Is there more overcrowding than there is in Bangalore?—I should think that it is about the same; there is very little to choose in that respect; but, as regards the appearance of the town, and the position, I think I should say that Mysore was distinctly more insanitary.

24,985. Are they the same class of people?—Yes, practically.

24,986. Will you tell us how many cases have been treated in their houses, and how many in the hospital?—I did not come to Bombay prepared to give evidence, and I have no figures. Mr. Cadell has them.

24,987. Can you tell me whether the mortality is greater amongst the people who have been treated in their own houses, or amongst the people in hospitals?—That I cannot tell. If Mr. Cadell has not got these figures, it will be quite easy to get them.

24,988. You say that the houses were disinfected as soon as a patient was reported?—That I believe is the order.

24,989. Is the house disinfected again after death?—I am not sure about that.

24,990. Do you know how the house is disinfected?—Yes, I watched it being done. That is perhaps a rather weak point in the Mysore work; I do not think the disinfection is under sufficiently competent supervision. This, however, is a detail in working.

24,991. Who is in charge of the disinfection?—They have a European of no particular status.

24,992. A medical man?—No.

24,993. (*Mr. Cumine.*) Do you find that leaving a patient in his house leads to many of the other members of the family catching the disease?—I asked them in Mysore particularly to record facts about this, because I recognised that it was one of the most important points; they have done so to some extent, and Mr. Cadell will produce the figures.

24,994. (*The President.*) When did the plague commence in Mysore?—I do not know the exact date of the first case, but I think it was in November or December. Mr. Cadell has the figures of when the cases began.

24,995. From the commencement, the system which you have just described has been in operation?—Yes.

24,996. The so-called voluntary system?—Yes.

24,997. During this time, has plague to your knowledge steadily increased in Mysore?—No, it has fluctuated. It increased up to a certain point and now the tendency is a downward one. There is no marked rapid fall, but the last telegrams I got stated that the total mortality was 26 per diem.

24,998. You cannot distinguish the plague cases?—Yes, but I believe in a town like that, that the only safeguard is the total mortality.

24,999. What do you estimate the plague deaths at?—In these figures that are given me, the total mortality being, say 26, the plague deaths would be about 19 per diem, the normal mortality being about six or seven.

25,000. We had the opportunity of seeing the houses when we were in Bangalore; are the houses in Mysore about the same?—Yes.

25,001. There are a good many one-chambered houses?—Yes, very rarely more than one storey; but they are easier to disinfect. I do not know whether you remember that in Bangalore there are many flat roofs, in Mysore they are nearly all gable roofs and tiles.

25,002. How does that facilitate the disinfection?—Because you can take off the roofs.

25,003. In disinfection you include the removal of tiles?—Yes, and letting in the sun and air.

25,004. Air and sun disinfection, as well as chemical disinfection?—Yes.

25,005. I do not quite understand how this disinfection is effected in one-roomed houses when the patient is in the house?—I mean one storey houses: the houses have small rooms, and as a rule they are one-storeyed.

25,006. The floor, I suppose, is of the same nature as in Bangalore—mud?—Yes, mostly mud with cow-dung.

25,007. The houses are usually quite dark?—Yes, certainly.

25,008. You, I understand, are not in a position as yet to give any definite opinion as to the success of this system?—Not definitely, except intermediately that everything points at present to a favourable conclusion.

25,009. It has gone on since October or November?—Not so early as that. I think the first cases were in December. All the first cases were imported, but I think the first indigenous cases were in December.

25,010. On the whole it is on the decline?—Yes, I think there is a downward tendency.

(Witness withdrew.)

Mr. P. R. Cadell, I.C.S.
14 Mar. 1899.

Mr. P. R. CADELL, I.C.S., recalled and further examined.

25,011. (*The President.*) We wish some further information from you with regard to Bangalore City?—Yes.

25,012. (*Mr. Hewett.*) You have some figures with regard to the Civil and Military Station which will supplement Colonel Robertson's evidence at Bangalore Will you kindly put them in?—Yes.

25,013. First of all, will you state what they are?—Firstly, the progress of disease by wards in Bangalore and Mysore.

STATEMENT I.

BANGALORE CITY.

NUMBER of DEATHS from all Causes by WARDS from 12th August 1898 to 28th February 1899.

Ward Number.	Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
Ward I.	20,663	1,545	7·5	138
Ward II.	27,095	2,670	9·9	182
Ward III.	11,843	1,090	9·2	169
Ward IV.	20,684	1,793	8·7	160
Total	80,285	7,098	8·8	163

BANGALORE, CIVIL AND MILITARY STATION.

PROGRESS of the DISEASE by WARDS from 15th September to 28th February 1899.

Circle Number.	Population.	Plague Attacks.	Percentage to Population.	Plague Deaths.	Percentage to Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
I.	4,774	49	1	37	·8	60	1·3	27
II.	16,196	610	3·7	512	3·1	1,102	6·8	148
III.	5,514	392	7·1	295	5·3	426	7·7	168
IV.	2,174	87	4	64	2·9	87	4	87
V.	5,413	356	6·5	295	5·4	411	7·6	166
VI.	11,233	525	4·6	416	3·7	655	5·8	126
VII.	10,916	177	1·6	144	1·3	309	2·8	61
VIII.	10,912	510	4·7	439	4	695	6·4	139
IX.	9,844	257	2·6	215	2·2	430	4·4	96
X.	3,841	158	4·1	146	3·8	201	5·2	113
XI.	2,264	100	4·4	99	4·4	165	7·3	159
XII.	4,562	267	5·9	225	4·9	568	12·3	268
XIII.	8,318	382	4·6	340	4·1	925	11·1	242
XIV.	4,120	48	1·1	25	·5	55	1·3	27
Outside limits and unknown.	—	82	—	46	—	46	—	—
Total	100,081	4,060	4	3,298	3·3	6,130	6·1	133

MYSORE CITY.

PROGRESS of the DISEASE by WARDS from 1st October 1898 to 28th February 1898.

Ward Number.	Population.	Plague Attacks.	Percentage to Population.	Plague Deaths.	Percentage to Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
1	33,251	1,356	4·1	1,074	3·2	2,155	6·5	156
2	31,187	470	1·5	387	1·2	977	3·1	75·2
3	9,610	104	1·1	53	·6	76	·8	19·
Total	74,048	1,930	2·6	1,549	2	3,208	4·3	104

NOTE.—No death from any cause is recorded from Ward III. from 1st October to 20th January, which suggests some inaccuracy and is being inquired into.

The deaths in Ward III., which was only constituted on 18th January, have, up to that time, been recorded under Wards I. and II.

25,014. Have you returns of deaths among races?—Yes.

25,015. Will you put them in, all three—for Bangalore City, the Civil and Military Station, and Mysore?—Yes.

STATEMENT II.

BANGALORE CITY.

NUMBER of DEATHS from all Causes by RACES from 12th August 1898 to 28th February 1899.

	Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
Hindus and others	67,388	5,280	7·8	145
Muhammadans	10,472	1,671	15·9	294
Native Christians	2,425	147	6·1	112
Total	80,285	7,098	8·8	163

BANGALORE, CIVIL AND MILITARY STATION.

MORTALITY by RACES from 15th September to 28th February 1899.

——	Population.	Plague Attacks.	Percentage to Population.	Plague Deaths.	Percentage to Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
Europeans - -	4,985	18	·3	12	·2	37	·74	16
Eurasians - - -	2,649	47	1·7	35	1·3	77	2·9	63
Native Christians -	10,268	414	4·4	320	3·1	517	5	109
Muhammadans - -	23,892	871	3 6	789	3·3	1,881	7·9	172
Hindus and others -	58,287	2,650	4·5	2,142	3·7	3,611	6·2	135
Total - -	100,081	4,000	4	3,298	3·3	6,130	6·1	133

MYSORE CITY.

SPREAD of the DISEASE by RACES up to 28th February 1899, from 1st October 1898.

——	Population.	Plague Attacks.	Percentage to Population.	Plague Deaths.	Percentage to Population.	Total Mortality.	Percentage to Population.	Ratio per Mille per Annum.
Hindus and others -	58,741	1,345	2·3	1,026	1·7	2,223	3·8	·91
Muhammadans - -	15,307	585	3·8	493	3·2	985	6·4	155
Total - -	74,048	1,930	2·6	1,519	2	3,208	4·3	104

25,016. Is there any point you would like to call our attention to with regard to those three returns?—As regards the races in all three cities, the Muhammadans suffered much the most severely.

25,017. Are the Muhammadans in all those three towns in a depressed condition?—Yes, they are all poor—very much poorer than the Muhammadans elsewhere; and they are much more crowded, I think, than the Muhammadans elsewhere in their houses.

25,018. When you say the Muhammadans have suffered more than other classes, I suppose you are deducing your conclusion from the total mortality rather than from the number of recorded plague attacks?—From the total mortality.

25,019. On the ground that the difference between the normal mortality and the mortality during the plague outbreak is practically attributable to plague?—For Mysore City and Bangalore Civil and Military Station I have the plague figures as well as the total mortality. In the Civil and Military Station the Muhammadans, from recorded plague deaths, suffered less than the Hindus; but their total mortality was considerably higher. In Mysore, both from the recorded plague deaths and the total percentage of the population, it was higher than in the Hindus.

25,020. And Bangalore City?—In Bangalore City the record of deaths from plague was so inaccurate that I could not get the figures. I have got the total mortality.

25,021. Do the Muhammadans in those three towns live in more overcrowded houses than the other portions of the population?—No; I could not say that.

25,022. Have you any other reason which you can offer for their being attacked more than the Hindus?—Except that there was greater concealment in the Civil and Military Station among the Muhammadans, and where, in the end, the Hindus have been got to report the cases early, the Muhammadans never did it in the Civil and Military Station. A much smaller proportion of the Muhammadans, also, underwent inoculation.

25,023. You think the fact that they had plague cases and that no precautions were taken may have increased the plague mortality among them?—I think so.

25,024. The next statement you put in is one relating to the hospital figures?—Yes. The statements with regard to Bangalore City, Civil and Military Station, and Mysore City, are as follow:—

STATEMENT III.

HOSPITAL FIGURES: TOTAL ADMISSIONS.

Hospital.	Admissions.	Discharges.	Deaths.	Percentage of Mortality.	Remaining.
Bangalore City - -	2,131	709	1,422	66·7	—
Civil and Military Station:—					
North Camp - -	940	336	596	63·4	8
South Camp - -	768	306	462	60·2	—
Total - -	1,708	642	1,058	61·9	8
Mysore - - - -	206	20	101	49	85

NOTE.—The hospital figures for Mysore are up to the 28th February, and for the Civil and Military Station up to the 3rd of March, 1899.

25,025. In the figures for the Plague Hospital of Mysore City, you show the total admissions to the hospital to have been 206; could you give us any estimate as to the number of persons suffering from plague who were treated in their own houses in Mysore?—No, not those who were treated separately from those who died without treatment.

25,026. You cannot give any approximate estimate?—No, I am afraid not, as treatment was voluntary. The total mortality in the houses was, of course, higher.

25,027. Then you have a statement of hospital figures as regards the inoculates?—Yes. It is as follows:—

STATEMENT IIIA.

HOSPITAL FIGURES for INOCULATES.

——	Admissions.	Deaths.	Discharges or Convalescent.	Percentage of Mortality.
Bangalore City -	57	31	26	54·4
Civil and Military Station:—				
North Camp	87	24	63	27·6
South Camp	41	12	29	29·3
Total -	128	36	92	28·1
Mysore - -	26	9	Not shown	34·6

NOTE.—The figures for the Civil and Military Station are up to the 3rd of March, and those for Mysore up to the 28th of February, 1899. The figures for the Military Hospitals are contained in separate statements relating to the Military.

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25,028. And you have a statement of the number of cases of plague which occurred amongst the contacts?—Yes, for all three. The proportion of contacts in Mysore, where the contacts were all voluntary, was higher than in the Civil and Military Station.

STATEMENT IIIB.

ADMISSIONS to CONTACT CAMP.

—	Admitted.	Developed Plague.	Percentage developing Plague.	Died from other Causes.
Bangalore City -	3,960	238	6	—
Civil and Military Station:—				
North Camp	1,527	50	3·3	3
South Camp	887	25	2·8	—
Total -	2,414	75	3·1	3
Mysore City -	452	27	6	—

NOTE.—In the earlier stage of the epidemic, contacts in the Civil and Military Station were allowed to go out to their work. Many absconded, and the above numbers were, therefore, not all detained for ten days.

25,029. The camp was reserved for contacts in Mysore; it was not a health camp?—No, entirely a contact camp.

25,030. Have you any information to give us as to how long after the contacts came into camp they developed plague?—I have figures for the Civil and Military Station only. They are:—

Number developing plague—

On first day after arrival in camp -	26
,, second ,, ,, -	16
,, third ,, ,, -	5
,, fourth ,, ,, -	5
,, fifth ,, ,, -	8
,, sixth ,, ,, -	1
,, seventh ,, ,, -	3
,, eighth ,, ,, -	1
,, ninth ,, ,, -	7
,, tenth ,, ,, -	3
	75

25,031. Have you got the number of houses in which more than one seizure has been recorded?—It is as follows in Mysore:—

NUMBER of HOUSES from which more than ONE SEIZURE has been recorded.

In 76 houses there were		2	attacks.	
,, 26	,,	,,	3	,,
,, 4	,,	,,	4	,,
,, 6	,,	,,	5	,,
,, 4	,,	,,	6	,,
,, 2	,,	,,	7	,,
,, 1	,,	,,	10	,,
119				

In Bangalore City there was more than one seizure in 297 houses, but the exact number in each is not known.

25,032. In all the other houses in Mysore in which plague cases occurred, was there only one attack?—There could have been only one attack.

25,033. Do these figures refer only to cases definitely found to be due to plague?—Yes.

25,034. Have you a statement with regard to the number of inoculations performed in Bangalore City, Bangalore Civil and Military Station, and Mysore?—Yes, as follows:—

STATEMENT IV.

BANGALORE CITY.

SHOWING NUMBER of INOCULATIONS performed from 2nd September 1898 to 28th February 1899.

—	Number of Inoculations.	Remarks.
Week ending 8th September 1898	81	
,, 15th ,, ,,	241	
,, 22nd ,, ,,	328	
,, 29th ,, ,,	4,212	
,, 6th October ,,	4,384	
,, 13th ,, ,,	1,280	
,, 20th ,, ,,	1,108	
,, 27th ,, ,,	1,285	
,, 4th November ,,	2,667	
,, 11th ,, ,,	1,385	
,, 18th ,, ,,	2,134	
,, 25th ,, ,,	1,630	
,, 2nd December ,,	1,486	
,, 9th ,, ,,	1,506	
,, 16th ,, ,,	575	
,, 23rd ,, ,,	1,191	
,, 30th ,, ,,	976	
,, 6th January 1899	1,032	
,, 13th ,, ,,	677	
,, 20th ,, ,,	560	
,, 27th ,, ,,	1,134	
,, 3rd February ,,	836	
,, 10th ,, ,,	673	
,, 17th ,, ,,	601	
,, 24th ,, ,,	559	
From 25th February to 28th February 1899 - - -	332	
Total - - -	32,871*	

* Of these 1,350 were second inoculations.

CIVIL AND MILITARY STATION.

INOCULATION PERFORMED.

Week ending.	By Civil Officers.	By Military Officers.	
		First Inoculation.	Second Inoculation.
Up to 23rd September	1,075	—	—
,, 30th ,,	694	—	—
,, 7th October -	732	—	—
,, 14th ,, -	952	970	—
,, 21st ,, -	2,720	875	—
,, 28th ,, -	6,205	2,497	—
,, 4th November	4,558	4,784	—
,, 11th ,, -	1,068	1,899	—
,, 18th ,,	951	355	66
,, 25th ,, -	1,636	354	1,403
,, 2nd December	2,124	51	994
,, 9th ,, -	2,266	6	2,562
,, 16th ,, -	1,127	24	508
,, 23rd ,, -	756	—	100
,, 30th ,, -	555	—	—
,, 6th January -	686	—	—
,, 13th ,, -	741	—	—
,, 20th ,, -	500	—	—
,, 27th ,, -	582	—	—
,, 3rd February	398	—	—
,, 10th ,, -	322	—	—
,, 17th ,, -	223	—	—
,, 24th ,, -	220	—	—
,, 3rd March -	168	—	—
	31,259*	11,815	5,639

* Of these, 30,296 were first inoculations.
,, 963 were second ,,

Total first inoculations -	42,111
Total second ,, -	6,602
Number of inoculates reported attacked -	376
,, ,, ,, died	262

MYSORE CITY.

1.—INOCULATIONS PERFORMED.

—	First Inoculation.	Second Inoculation.
From commencement to 27th January - -	28,685*	65
Week ending 3rd February -	476	14
„ 10th „ -	201	2
„ 17th „ -	222	3
„ 24th „ -	82	5
Total - -	29,666	89

* Of these—
3,745 were done in October.
6,926 „ „ November.
15,251 „ „ December.
25,922

2.—NUMBER of INOCULATED PERSONS ATTACKED.

—	October.	November.	December.	January.	February.	Total.
Seizures - -	—	1	3	53	61	118
Deaths - -	—	1	2	38	43	84

—	Number of Inoculates attacked.	Number verified by Comparison with Certificates.	Percentage.	Deaths.	Percentage.	Number verified by Comparison with Certificates.	Percentage.
Removed to Hospital	26	—	—	9	34·6	—	—
Remained outside -	92	—	—	75	83·5	—	—
Total - -	118	98	83	84	71·2	62	73·8

25,035. You have endeavoured to get the information asked for from Col. Robertson with regard to the incidence of plague among the inoculated and uninoculated?—Yes.

25,036. Have you got that only for the Civil and Military Station?—We have only that accurately for the Civil and Military Station.

25,037. You put in other figures?—I have put them here for what they are worth, but for Mysore city they are inaccurate so far as regards the examination of bodies, and I would not vouch for them. The statement attached for the Civil and Military Station shows that of the cases actually seen and pronounced to be plague, 10·8 of the seizures and 9·4 of the deaths were among inoculated persons, against 85·1, or 85·5 respectively among the uninoculated; this is considerably lower than the proportion of the inoculated to the uninoculated population:—

STATEMENT No. V.

CIVIL AND MILITARY STATION.

PROPORTION of INOCULATED PERSONS ATTACKED to TOTAL NUMBER of ATTACKS and DEATHS.

Number of Plague Cases seen by Government Medical Officers and found to be or not to be inoculated.								Number of Cases seen by Hakims and pronounced to be plague.								Number of Bodies buried without Permit, and counted as Plague.
No. of Cases seen by Government Medical Officers.		No. of these found to be Inoculated.		No. of these found not to be Inoculated.		No. doubtful or Unknown.		No. of Cases seen by Hakims and pronounced Plague.		No. of these found to be Inoculated.		No. of these found not to be Inoculated.		No. of these Doubtful or Unknown.		
Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	
3,473	2,772	374	260	2,961	2,374	138	138	9	9	2	2	3	3	4	4	516

The remaining persons who died between 15th September and 28th February, were either seen by Medical Officers and certified not to have died of plague, or were seen by Hakims and Baids and pronounced not to have died of plague, or were buried without certificate, before the certificate rules came into force.

—	Number seen and pronounced to be Plague.	Percentage inoculated.	Percentage not inoculated.	Percentage unknown.
Attacks -	3,482	10·8	85·1	4·1
Deaths	2,781	9·4	85·5	5·1

25,038. Could you tell us how the fact of a person being inoculated or uninoculated was ascertained for the purpose of these returns?—Inquiries were always made in the household, and if possible a certificate was recovered.

25,039. Do you think that there is any margin of error by reason of any disposition of the people to retain the certificate?—I think there is a slight margin of error.

25,040. But you would not attach any material importance to it?—No. Inquiry was made on that point, and the medical officer said that they only found rare instances in which there was suspected transference of the certificates.

25,041. Can you tell us when the first indigenous case of plague took place in Mysore?—It was on the 26th November.

25,042. Do you know whether there was in Mysore any mortality among rats before cases began to occur?—I do not know.

25,043. Is Mysore city dirtier or cleaner than the town of Bangalore?—It is dirtier and generally more unhealthy. Amongst those who know them well, there is only one opinion, that Mysore is ordinarily a far dirtier and more unhealthy town than Bangalore. Col. Benson says the difference between the healths of the jails in each place is striking. It is true that this year there has been singularly little malarial fever in Mysore jail; but in general the town is extremely malarial, lying in a hollow, with no fall for its sewage. Mr. Architrao, Civil Surgeon of Mysore, writes, "The town is incom- "parably more filthy than the pettah of Bangalore. "In places like old Agrahar the houses are inde- "scribably damp for the greater part of the year."

25,044. Has past experience shown that epidemics of cholera attacked both places alike?—As regards liabilities to epidemics, both Bangalore, so far at least as the Civil and Military Station is concerned, and Mysore have been subject to visits of cholera, though in Mysore there has been no epidemic since 1891. Formerly it was more liable to cholera.

25,045. At the time of the year when plague broke out in Bangalore there was much more difficulty in dealing with the disease than at the time it broke out in Mysore, was there not?—Yes. In respect to climatic conditions it cannot be doubted that the plague attacked Bangalore

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at the more unfortunate period of the year. Both in October and November there was heavy rain, and this not only hampered all active operations carried out by the officials, but drove the people into their houses, just at the beginning of the cold weather. In Mysore, the disease has spread at a much drier season; the weather has become, for the Province, warm, and the season of the year is approaching in which the plague has, I think, usually dropped in Bombay.

25,046. When was this evil effect of climate most apparent as regards the epidemic in the Civil and Military Station?—From about the 11th to the 20th November in the Civil and Military Station.

25,047. Then it would not have been operating at the time that plague was at its worst in Bangalore city?—I could not say about Bangalore city from personal knowledge. There was rain in October, too. I cannot say what the exact effect was on the plague operations.

25,048. Do you think between the 22nd October and the 4th November, from what you have heard, that the operations in Bangalore city were seriously prejudiced by the rains at that time?—Yes, I was told so. I put in a statement of the rainfall, as follows:—

STATEMENT of RAINFALL in BANGALORE.

Day.	August.	September.	October.	November.	December.
1	—	0·10	—	—	0·40
2	—	—	—	—	0·01
3	0·14	0·36	0·16	—	—
4	0·01	0·07	0·10	—	—
5	—	2·29	—	0·51	—
6	0·11	2·57	—	0·66	—
7	0·06	0·13	0·05	1·75	—
8	—	2·45	—	1·50	—
9	—	0·82	—	—	—
10	—	0·02	—	0·01	—
11	—	0·01	0·17	0·25	—
12	—	0·11	—	0·03	—
13	0·15	0·02	—	0·21	—
14	0·07	0·03	—	0·40	—
15	0·37	—	0·17	0·01	—
16	—	—	0·01	0·01	—
17	—	—	2·59	—	—
18	—	—	—	—	—
19	—	—	0·02	—	—
20	—	0·37	—	—	—
21	—	0·13	—	—	—
22	—	—	—	—	—
23	—	0·66	—	—	—
24	—	—	0·08	—	—
25	—	1·41	—	—	—
26	0·50	0·66	0·10	0·12	0·04
27	0·37	0·64	0·13	0·03	—
28	0·04	0·06	—	0·02	—
29	0·08	0·01	—	—	—
30	—	—	—	0·18	—
31	0·26	—	—	—	—
Mean	2·16	11·93	3·58	5·69	0·45

No rain in January.

25,049. When the outbreak took place in Mysore, to what extent had inoculation been resorted to there?—By the end of November in Mysore 10,600 people had been inoculated, and by the end of December 26,000 people—over one-third of the population—had been inoculated.

25,050. And in Bangalore city and in Bangalore Civil and Military Station the people were not inoculated until plague was among them, were *they*?—No. At the end of October in the Civil and Military Station, by which time the plague had got very bad, there were only 12,000 persons inoculated: at the end of November 20,000 were inoculated. By that time the disease had begun to decrease so that less than one-fourth of the non-military population was inoculated before the disease turned.

25,051. You say in the précis of your evidence: "It "may be taken, I think, that Bangalore, both the "Civil and Military Station and city, underwent an "abnormally severe attack." What do you mean by that, precisely?—That there were a very large number of cases. I do not go into the causes of it at all, as I cannot say whether one type was more severe than the other.

25,052. You do not mean to say that the conditions of the epidemic were different?—No, I say that the results were different.

25,053. Will you kindly tell us the state of plague at present, first of all in Mysore and secondly in Bangalore Civil and Military Station?—In the Civil and Military Station it is practically extinct. Last week we had only five indigenous cases and the week before only four. They are all sporadic cases. With the exception of these sporadic cases plague is extinct.

25,054. Can you give us the total mortality of Bangalore city, the Civil and Military Station, and of Mysore city respectively up to date, from the beginning of the outbreaks?—In Bangalore city there have been 2,652 recorded deaths from plague. The total mortality has been 7,115, and taking an estimated daily death rate of seven from the normal causes, the excess over that normal is 6,016. In the Civil and Military Station there have been 3,306 recorded deaths from plague, a total mortality of 6,192, and taking the normal average of 9 per diem the excess over the normal since the beginning of the outbreak has been 4,779. In Mysore city there have been 1,592 deaths from plague. The total mortality has been 3,301. Taking the normal from other causes of 7 per diem, the excess over the normal is 2,202. So, roughly, it may be taken that plague mortality in Bangalore city was 6,000, in the Civil and Military Station it was 4,800, and in Mysore 2,200 up to date.

25,055. I believe you have prepared charts which show in respect to Bangalore city and Bangalore Civil and Military Station the normal mortality, the total mortality, and the plague mortality during both epidemics. And one for Mysore city shows the total recorded mortality and the total plague mortality?—Yes.*

25,056. Perhaps you will complete these two charts as to Mysore and Bangalore Civil and Military Station and send them to us by the end of April?—Yes.*

25,057. I believe you were at Bangalore Civil and Military Station when the disease was there in epidemic form?—Yes.

25,058. Did you observe any difference in the attitude of the people in the Bangalore Civil and Military Station and Mysore?—The difference has been very striking in the way the Mysore people have freely reported the cases. As far as we know they have not tried to remove the sick from the town or from the houses, and they have reported very freely indeed. In Bangalore Civil and Military Station they did not report until the very end and only after great compulsion. They also removed the sick to a very considerable extent.

25,059. Has the result been that you found plague at a much earlier stage in Mysore?—I believe so.

25,060. When you found a patient suffering from plague in Mysore, I understand that he was given the option of remaining in his house or going to the hospital?—Yes.

25,061. Were the patients urged to go to hospital as a rule?—They have been advised to go.

25,062. But the result has been that only a comparatively small number of the sick have gone?—Yes, comparatively few.

25,063. Supposing you found a plague patient sick in his house, what did you do with the people who were in the house with him?—If they agreed to allow the patient to remain in the house, nothing was done to the other people.

25,064. What was done to the house?—Nothing was done.

25,065. No disinfection?—No. The rule was that a house was not to be disinfected until the patient either died or recovered. As a matter of fact Col. Benson tells me that the houses have generally been disinfected excepting the room in which the patient has been living.

25,066. (*The President.*) At the commencement or afterwards?—Immediately.

25,067. (*Mr. Hewett.*) The room in which the patient was suffering was left alone till the patient either recovered or died?—Yes.

* *See* App. No. LXXI. (i) to (iv) in this Volume. The charts have not been completed beyond the beginning of March.

25,068. The whole of the family were permitted to visit him, I suppose, where he was lying?—Yes.

25,069. Does the patient as a rule lie on the floor or on a bed?—In Mysore, on the floor.

25,070. Have you observed whether the plague has moved more rapidly about different parts of Mysore city than it did about the Civil and Military Station at Bangalore?—It moved very much more slowly in Mysore.

25,071. To what do you attribute that?—To the people not being disturbed and not moving. I do not think there has been any other cause, unless the disease can be said to have been, of itself, more virulent in Bangalore.

25,072. Has there been any panic in Mysore?—No, none.

25,073. And the ordinary business has been conducted throughout the epidemic?—Yes, throughout the epidemic.

25,074. Has there been any exodus of the people to outlying parts of the country?—A large number have gone—about 20,000—but not nearly to the same extent as in Bangalore city.

25,075. Have you had any opportunity of ascertaining whether the neighbourhood of Mysore has been infected as much as Bangalore?—It has been far less affected. In Bangalore the whole of the surrounding tálukas were highly infected.

25,076. Do you think that the fact that the neighbourhood of Mysore has not been so badly infected may to a certain extent be accounted for by the villagers knowing more about the measures?—Yes, and in being more careful in keeping strangers out.

25,077. Do you think that this is the only circumstance which has affected the extent of the infection near Mysore?—There is the fact of their camping out. In Mysore, they certainly did learn that lesson thoroughly. They camped out very early on the appearance of the disease. I think something must be assigned to the fact, that far fewer sick people were taken out than in the case of Bangalore.

25,078. Have you observed anything else with reference to the relative treatment in hospital in Bangalore, and in the Civil and Military Station and Mysore city?—There are so many still remaining under treatment in Mysore hospital that I do not think it is safe to draw any deductions. The figures are so far more satisfactory in Mysore. In Mysore the mortality has been 49 per cent. so far; whereas in the Civil and Military Station the mortality was 61 per cent., and in Bangalore 66 per cent.; but, of course, the numbers in the Mysore hospital have been smaller.

25,079. Have you any reason for thinking that the voluntary system, as adopted in Mysore, will, in the long run, lead to a greater extension of plague in Mysore city?—I think it is inevitable it will spread over the whole city. It is spreading. It is attacking quarters which have hitherto been free. I think it is inevitable that it must go all over the town.

25,080. Do you think that it is likely that it will be more severe than if the system adopted in Bangalore city and Civil and Military Station were adopted?—I do not think there will be as high a mortality as in Bangalore.

25,081. I am speaking of the city?—Yes.

25,082. I understand you to say that apart from the city itself, the result of the voluntary system will be, to a certain extent, that the neighbourhood will suffer less severely than it did at Bangalore?—Yes, so far as we can say at present.

25,083. That would rather tend to show that the disease is less likely to extend from a place in which the voluntary system is at work?—Yes.

25,084. Do you think that the disinfection which has been carried out at Mysore has been effectively carried out?—I do not think so. There has been very little European supervision in Mysore—only one or two subordinates.

25,085. Do you think that disinfection under a system, such as you have had in Mysore, might have been properly carried out if you had had proper supervision?—I do not see how it could be. According to the rule, the people may object to their houses being disinfected until the patient has died or recovered. It gives infection a very long time to spread.

25,086. Why do the people object to a house being disinfected before the patient has died?—It is the Darbar's rule that the house need not be disinfected until then. Even if the house was disinfected, with the exception of the room in which the patient was lying, there would obviously be danger of fresh infection to the house as long as the patient remained ill in it.

25,087. Have the people of Mysore displayed any objection to disinfection?—I believe they did at first, but to a very small extent.

25,088. Has the effect of this system been that people have been in better heart during the epidemic?—I think so. I saw a very marked difference in the demeanour of the people in Mysore than in Bangalore.

25,089. Has this voluntary system caused greater or less expense than the one adopted in the Civil and Military Station?—Far less expense. The system of the Civil and Military Station was extremely expensive, whereas in Mysore, there was very little expense indeed.

25,090. In addition to the other evils which existed in Bangalore Civil and Military Station, was there any difficulty owing to the staff running away?—The sweepers in the early part of the epidemic ran away—they struck.

25,091. Did you find any difficulty of that sort in Mysore?—No, but that could have had nothing to do with the system, except as to the results—that the extent of the disease and the high mortality might make the sweepers strike. The sweepers themselves would not be influenced by the plague measures.

25,092. Were they influenced particularly by fear of death?—Yes, and by the desire to earn higher wages—reasons which would cause an ordinary strike.

25,093. Do you think that it would be possible to combine the evacuation of infected quarters with the voluntary system?—I think so. The officers of Mysore say it would have been impossible in Mysore without disturbing the people unduly. I think it would be possible in a second epidemic, and I think in most places it would be possible to persuade the people in a first outbreak.

25,094. Would you explain exactly what you mean by a combination of the two—how would you combine the systems?—By combination I mean telling the people that they must leave an infected quarter, and providing huts for them, and saying they must go there; and as far as the sick are concerned, taking their sick with them, and having no segregation amongst them of any contacts, or even of the sick, except what they carried out themselves—simply making the people leave the infected quarter, and go to another place; otherwise leaving them entirely at liberty, though, if necessary, forbidding them to go to adjoining villages.

25,095. That is to say, under such a system there would be no compulsion as regards going to hospital, and no compulsion as regards being placed in the contact camp?—That is so.

25,096. (*Dr. Ruffer.*) How did you disinfect the houses in Mysore?—The actual work in Mysore was entirely under the Darbar—the State officials. I cannot talk of the actual work.

25,097. How was it done?—The disinfection was done on the same system as it was done in Bangalore.

25,098. Did you provide rules for disinfection?—Yes; the Mysore State had rules.

25,099. Can you put those in?—Yes, they are as follows:—

"10. *Disinfection.*—When it is provided in these rules, or in any others, which are or may be in force in the cities of Bangalore and Mysore that disinfection may be employed, disinfection as follows, as often as seems to him necessary, may be ordered by any plague authority, unless where otherwise provided:—

"*Of the Person.*—In a bathing tub, with Jeyes' fluid or carbolic acid, strength, 1 in 100.

"*Of Travellers' Bundles.*—(1) If specially ordered by the President, or any officer deputed for the purpose, to be opened out and steamed for 20 minutes by steam pressure of 20 lbs. and temperature 250° or (2) otherwise, to be treated as below.

"*Of Clothes, Silks, &c.*—To be exposed first one side then the other, for eight hours in a strong sun.

"*Other Cloths, &c.*—In perchloride of mercury, 1 in 1,000.

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"*Of an infected House.*—If its value is Rs.100 or less, and there is no danger of the fire spreading, it may be burnt. Otherwise, if a plague authority so directs, it may be unroofed and treated as provided in the next paragraph, after removal of all surrounding obstructions (walls, huts, sheds, pandals, &c.), to ensure a complete perflation of air.

"*Of Houses in an infected Area.*—Each house shall be opened to light and air in its dark rooms. Infected things of small value, such as bedding, cots, &c., may be burnt. Everything else, as well as the entire interior of the house, including the floor, shall be sprayed or sprinkled with perchloride of mercury. The floor of the rooms used by the sick person shall, if of earth, be dug out to a depth of two inches, and removed to a spot well away from habitations, and thoroughly burnt. Rubbish shall be burnt or carted away. Then the exterior and interior of the house shall be limewashed, chloride of lime being mixed with the limewash.

"*Of other Places and Spaces in such an Area.*—As any plague authority may direct."

25,100. What do you mean by saying that the cases in Bangalore now are sporadic?—I mean scattered and unconnected with each other. The five indigenous cases we had last week occurred in five different quarters of the town. There was not any particularly infected locality, and the week before, similarly, six cases were found in five different quarters.

25,101. Did you have corpse inspection in Mysore?—Yes, there has been corpse inspection.

25,102. Has every dead body been seen?—Yes, after the 22nd January.

25,103. Are you inspecting all the bodies now?—I believe so, in Mysore and in the Civil and Military Station they are now inspecting all the bodies.

25,104. Do you think there was much difficulty in examining the bodies of women?—I cannot say to what extent it was carried out in Mysore, whether it was strictly carried out or not. In the Civil and Military Station, all the bodies of women have been examined by females.

25,105. Do you know whether there have been any disturbances owing to corpse inspection?—No disturbance.

25,106. Did you give any special advantages to inoculated people?—Not in Mysore, because there were no special advantages to give to anybody, as there were no restrictions.

25,107. Have you any knowledge of inoculated people leaving the place?—They undoubtedly did so in large numbers in Bangalore.

25,108. I am speaking of Mysore?—In Mysore, no. I think a certain number would get inoculated because they know inoculated people have greater privileges on the railway.

25,109. You think that people get inoculated to go away?—Yes, a certain number.

25,110. That was the case in Bangalore was it not?—Yes.

25,111. A great many inoculated people did leave Bangalore, did they not?—Yes. In Bangalore city, out of 28,000 inoculates 12,000 are stated to have left.

25,112. Will you turn to Statement No. IV. about Mysore city? When you say the number of inoculates attacked, I suppose you mean the number you know of?—Yes.

25,113. There may have been more than that number attacked?—I do not think there is any reason to suppose there may have been many more, because inquiry was always made in the case of death.

25,114. There may have been many more attacked than were registered, might there not?—Not many, in Mysore they got the reports of the attacks, and they would always inquire.

25,115. You think the reports were accurate?—Yes, the people had no reason for misleading in Mysore.

25,116. You say "number of inoculates, 178, number "verified by comparison certificates, 98"?—Yes.

25,117. That means, that in 20 cases you could not find the certificate?—Either the certificate could not be found or the entry could not be found in the register.

25,118. So that there is a possibility of 17 per cent. of people having died who were not inoculated, or that the certificates had disappeared, or had been kept by the people themselves?—Yes, or that the inoculation had been done in all cases, and that the register had not been properly kept.

25,119. So that there is a possibility of an error of 17 per cent.?—Yes.

25,120. (*The President.*) With regard to the Statement No. I. referring to Mysore city, how do you account for the very large number of cases in Ward No. 1 relatively to other wards?—I think the return is unreliable, because the deaths in the third ward were not separately entered till the 13th January. Therefore, I think a great number of them may have been entered under the first ward.

25,121. The figures are not altogether reliable?—No, but the disease has been worse in the first ward. It started there.

25,122. It was worse there?—It has been actually worst there. I do not think the ward was worse than the other parts of the town from a sanitary point of view.

25,123. It only commenced there?—Yes, it got a footing there.

25,124. You have already expressed the opinion that Mysore is, on the whole, a dirtier place than Bangalore?—Yes.

25,125. Is there any difference with regard to overcrowding or the character of the houses?—The back streets are generally narrow and dirty in Mysore. I cannot speak of the overcrowding.

25,126. There is a larger population, I suppose, in a smaller space?—Yes.

25,127. Overcrowding is not only in the houses but in the area, I suppose?—In the area. I do not know about overcrowding in the houses. The area is smaller.

25,128. I see that you have made some reference to cholera having practically disappeared from Mysore since 1891?—Yes.

25,129. Can you tell us what kind of water supply there is in Mysore?—Cholera has disappeared since the new water supply was introduced.

25,130. Why do you think disinfection is quite useless under this voluntary system?—Because there is no certainty of doing it in time, and it can very likely only be done several days after the infection has had a start.

25,131. Therefore, if the voluntary system has any advantage, it is independent of any advantage gained by disinfection?—That is so.

25,132. You do not think it quite fair to compare the conditions in Bangalore so far as plague is concerned, with the conditions in Mysore, at present?—I think it would be dangerous to draw too strict a comparison between the two places.

25,133. Experience may, for anything you know, show that it would become much worse in Mysore than it has been even in Bangalore?—Yes, it might; but it does not seem likely to do so.

25,134. What was the great difference in the system pursued in Bangalore compared with the system followed in Mysore?—In Bangalore there was compulsory segregation—the sick person was always taken off to the hospital at once, and the persons living in the same house were removed to the segregation camp for ten days. In Mysore, no person has been removed to hospital except of their own consent, or with that of their relatives, and taking people to the segregation camp has been entirely voluntary. No one has been obliged to go there who did not wish to go.

25,135. Therefore, Mysore had not the advantages of so-called evacuation?—No, there was no evacuation in Mysore.

25,136. Therefore, there is no comparison to be made between Mysore and Bangalore with regard to evacuation in one and its absence in the other?—With regard to evacuation in large areas, in neither; but in Bangalore Civil and Military Station there was evacuation in some small areas, but that was subsidiary to other plague measures.

25,137. But judging between the native towns in both cases?—There has been no evacuation on a large scale in either.

25,138. I think you wish to put in some further tables which you have prepared, regarding the military population, and to make a statement with regard to the number of uninoculated people?—Yes, the statements are as follows:—

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2ND MADRAS LANCERS.

	Fighting Men.		Followers and Families.		Plague Attacks.											
					Fighting Men.						Followers and Families.					
					Among uninoculated.		Among once inoculated.		Among twice inoculated.		Among uninoculated.		Among once inoculated.		Among twice inoculated.	
	Number once inoculated.	Number twice inoculated.	Number once inoculated.	Number twice inoculated.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	61	—	283	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 21st „	186	—	718	—	1	—	—	—	—	—	—	—	—	—	—	—
„ 28th „	360	—	816	—	2	2	—	—	—	—	—	—	—	—	—	—
„ 4th November 1898	492	—	1,085	—	—	—	3	2	—	—	2	1	—	—	—	—
„ 11th „	541	—	1,112	—	—	—	5	4	—	—	5	4	6	4	—	—
„ 18th „	553	—	1,298	—	—	—	1	—	—	—	—	—	6	4	—	—
„ 25th „	251	303	863	435	—	—	—	—	—	—	—	—	—	—	—	—
„ 2nd December 1898	181	373	805	493	—	—	2	1	—	—	—	—	1	1	—	—
„ 9th „	127	427	708	590	—	—	—	—	—	—	—	—	1	—	—	—
„ 16th „	67	487	653	645	—	—	1	—	—	—	—	—	1	1	1	1
											Afterwards free.				—	—
Total	—	—	—	—	3	2	12	7	—	—	7	5	15	10	1	1

	Fighting Men.	Followers and Families.
Total strength	554	1,298

	Seizures.	Deaths.
Total among uninoculated	10	7
„ once inoculated	27	17
„ twice „	1	1
Total	38	25

"Q. O." SAPPERS and MINERS.

	Fighting Men.		Followers and Families.		Plague Attacks.											
					Fighting Men.						Followers and Families.					
					Among uninoculated.		Among once inoculated.		Among twice inoculated.		Among uninoculated.		Among once inoculated.		Among twice inoculated.	
	Number once inoculated.	Number twice inoculated.	Number once inoculated.	Number twice inoculated.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	380	—	43	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 21st „	382	—	43	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 28th „	749	—	778	—	2	2	—	—	—	—	6	4	—	—	—	—
„ 4th November 1898	766	—	1,532	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 11th „	767	—	1,584	—	—	—	2	—	—	—	—	—	2	2	—	—
„ 18th „	740	28	1,589	38	—	—	1	—	—	—	—	—	4	—	—	—
„ 25th „	738	30	1,560	67	—	—	5	3	—	—	—	—	1	—	—	—
„ 2nd December 1898	421	347	1,536	109	—	—	—	—	—	—	—	—	—	—	—	—
„ 9th „	348	421	1,345	306	—	—	1	1	—	—	—	—	2	1	—	—
Total	—	—	—	—	2	2	9	4	—	—	6	4	9	3	—	—
											Afterwards free.					

	Fighting Men.	Followers.
Total strength	769	1,651
Evacuated lines on		
Cases after evacuation		

	Seizures.	Deaths.
Total among uninoculated	8	6
„ once inoculated	18	7
Total	26	13

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1st Madras Pioneers.

	Fighting Men.		Followers and Families.		Plague Attacks.											
					Fighting Men.						Followers and Families.					
					Among uninoculated.		Among once inoculated.		Among twice inoculated.		Among uninoculated.		Among once inoculated.		Among twice inoculated.	
	Number once inoculated.	Number twice inoculated.	Number once inoculated.	Number twice inoculated.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 21st „	251	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 28th „	315	—	54	—	1	1	—	—	—	—	—	—	—	—	—	—
„ 4th November 1898	528	—	532	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 11th „	772	—	785	—	—	—	—	—	—	—	—	—	1	—	—	—
„ 18th „	772	—	785	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 25th „	554	221	759	26	—	—	—	—	—	—	—	—	—	—	—	—
„ 2nd December 1898	554	221	759	26	—	—	—	—	1	1	—	—	—	—	—	—
„ 9th „	348	447	736	50	—	—	—	—	1	1	—	—	—	—	—	—
„ 16th „	213	584	727	59	—	—	—	—	—	—	—	—	—	—	—	—
„ 23rd „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
„ 30th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 6th January 1899	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
„ 13th „	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
„ 20th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	1	1	—	—	2	2	—	—	5	—	1	1

	Fighting Men.	Followers.		Seizures.	Deaths.
Strength	797	786	Total among uninoculated	1	1
			„ once inoculated	5	—
			„ twice „	3	3
			Total	9	4

17th Madras Infantry.

	Fighting Men.		Followers and Families.		Plague Attacks.											
					Fighting Men.						Followers and Families.					
					Among uninoculated.		Among once inoculated.		Among twice inoculated.		Among uninoculated.		Among once inoculated.		Among twice inoculated.	
	Number once inoculated.	Number once inoculated.	Number once inoculated.	Number once inoculated.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	193	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 21st „	193	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 28th „	304	—	78	—	1	1	—	—	—	—	—	—	—	—	—	—
„ 4th November 1898	762	—	768	—	1	1	1	1	—	—	—	—	—	—	—	—
„ 11th „	774	—	932	—	—	—	1	1	—	—	—	—	—	—	—	—
„ 18th „	774	—	932	—	—	—	—	—	—	—	—	—	2	1	—	—
„ 25th „	591	185	787	145	—	—	3	3	—	—	—	—	—	—	—	—
„ 2nd December 1898	320	460	582	377	—	—	1	—	—	—	—	—	—	—	—	—
„ 9th „	142	638	406	553	—	—	—	—	—	—	—	—	1	1	—	—
„ 16th „	63	717	258	701	—	—	—	—	—	—	—	—	2	1	—	—
„ 23rd „	50	730	171	788	—	—	—	—	—	—	—	—	—	—	—	—
„ 30th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 6th January 1899	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
„ 13th „	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
„ 20th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 27th „	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
„ 3rd February 1899	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	2	2	7	5	—	—	—	—	7	3	—	—

	Fighting Men.	Followers.		Seizures.	Deaths.
Strength - -	780	959	Total among uninoculated - -	2	2
			„ once inoculated - -	14	8
			„ twice „ -	—	—
			Total -	16	10

FOLLOWERS and their FAMILIES of the COMMISSARIAT and TRANSPORT DEPARTMENT.

	Number once inoculated.	Number twice inoculated.	Plague Attacks. Among uninoculated.		Among once inoculated.		Among twice inoculated.	
			Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	—	—	—	—	—	—	—	—
„ 21st „ -	56	—	2	2	—	—	—	—
„ 28th „ -	418	—	—	—	—	—	—	—
„ 4th November 1898	739	—	—	—	—	—	—	—
„ 11th „ -	988	—	—	—	—	—	—	—
„ 18th „ -	1,088	—	—	—	—	—	—	—
„ 25th „ -	1,215	57	—	—	—	—	—	—
„ 2nd December 1898	1,215	57	1	—	1	—	—	—
„ 9th „ -	1,166	106	—	—	1	1	—	—
„ 16th „ -	1,146	126	2	1	5	3	—	—
„ 23rd „ -	—	—	—	—	1	1	—	—
„ 30th „ -	—	—	—	—	—	—	—	—
„ 6th January 1899	—	—	—	—	—	—	—	—
„ 13th „ -	—	—	—	—	1	1	—	—
„ 20th „ -	—	—	—	—	—	—	—	—
„ 27th „ -	—	—	—	—	—	—	—	—
„ 3rd February 1899	—	—	—	—	1	—	—	—
Total - -	—	—	5	3	10	6	—	—

Total Strength.		Seizures.	Deaths.
1,272	Total among uninoculated - -	5	3
	„ inoculated - - -	10	6
	Total - -	15	9

FOLLOWERS and their FAMILIES of 4TH (Q. O.) HUSSARS.

	Number once inoculated.	Number twice inoculated.	Plague Attacks. Among uninoculated.		Among once inoculated.		Among twice inoculated.	
			Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	—	—	—	—	—	—	—	—
„ 21st „ -	—	—	—	—	—	—	—	—
„ 28th „	—	—	8	8	*2	*1	—	—
„ 4th November 1898	948	—	2	2	10	9	—	—
„ 11th „ -	1,033	—	13	12	2	2	—	—
„ 18th „ -	1,053	—	8	8	2	2	—	—
„ 25th „ -	1,105	—	2	—	1	1	—	—
„ 2nd December 1898	1,105	—	—	—	—	—	—	—
„ 9th „ -	487	618	—	—	—	—	—	—
„ 16th „ -	—	—	Afterwards free.		—	—	—	—
Total - -	—	—	33	30	17	15	—	—

* This does not agree with the date on which inoculation is stated to have begun.

Evacuated Quarters on 17th November.

Seizures after Evacuation.		Seizures.	Deaths.
3	Total among uninoculated - -	33	30
	„ inoculated - - - -	17	15
	Total - -	50	45

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FOLLOWERS and their FAMILIES of J BATTERY, ROYAL HORSE ARTILLERY.

	Number once inoculated.	Number twice inoculated.	Plague Attacks.					
			Among uninoculated.		Among once inoculated.		Among twice inoculated.	
			Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	—	—	—	—	—	—	—	—
„ 21st „	—	—	—	—	—	—	—	—
„ 28th „	—	—	—	—	—	—	—	—
„ 4th November 1898	505	—	—	—	—	—	—	—
„ 11th „	505	—	—	—	—	—	—	—
„ 18th „	505	—	—	—	1	1	—	—
„ 25th „	505	—	—	—	1	1	—	—
„ 2nd December 1898	505	—	—	—	—	—	—	—
„ 9th „	93	412	1	1	—	—	—	—
„ 16th „	93	412	—	—	1	1	—	—
Total	—	—	1	1	3	3	—	—

Not evacuated.

	Seizures.	Deaths.
Total among uninoculated	1	1
„ inoculated	3	3
Total	4	4

FOLLOWERS and their FAMILIES of the 21ST FIELD BATTERY, ROYAL ARTILLERY.

	Number once inoculated.	Number twice inoculated.	Plague Attacks.					
			Among uninoculated.		Among once inoculated.		Among twice inoculated.	
			Seizures.	Deaths.	Seizures.	Deaths.	Seizures.	Deaths.
Week ending 14th October 1898	—	—	—	—	—	—	—	—
„ 21st „	—	—	—	—	—	—	—	—
„ 28th „	—	—	—	—	—	—	—	—
„ 4th November 1898	485	—	—	—	—	—	—	—
„ 11th „	595	—	—	—	—	—	—	—
„ 18th „	595	—	1	1	4	4	—	—
„ 25th „	595	—	1	1	—	—	—	—
„ 2nd December 1898	595	—	—	—	1	1	—	—
„ 9th „	372	223	1	1	1	1	—	—
„ 16th „	—	—	—	—	4	3	—	—
„ 23rd „	—	—	—	—	1	—	—	—
Total	—	—	3	3	11	9	—	—

Evacuated on 12th December 1899.

Seizures After Evacuation.		Seizures.	Deaths.
3	Total among uninoculated	3	3
	„ inoculated	11	9
	Total	14	12

FOLLOWERS and their FAMILIES of 25TH FIELD BATTERY, ROYAL ARTILLERY.

	Number once inoculated.	Number twice inoculated.	Plague Attacks. Among uninoculated. Seizures.	Among uninoculated. Deaths.	Among once inoculated. Seizures.	Among once inoculated. Deaths.	Among twice inoculated. Seizures.	Among twice inoculated. Deaths.
Week ending 14th October 1898	—	—	—	—	—	—	—	—
„ 21st „	—	—	—	—	—	—	—	—
„ 28th „	459	—	—	—	—	—	—	—
„ 4th November 1898	459	—	—	—	1	1	—	—
„ 11th „	578	—	—	—	1	1	—	—
„ 18th „	578	—	—	—	1	1	—	—
„ 25th „	667	—	2	2	—	—	—	—
„ 2nd December 1898	667	—	—	—	2	2	—	—
„ 9th „	427	240	4	4	6	6	—	—
„ 16th „	—	—	—	—	1 Afterwards free.	—	—	—
Total - -	—	—	6	6	12	11	—	—

Evacuated on 12th December 1898.

Strength.	Seizures after Evacuation.		Seizures.	Deaths.
667	1	Total among uninoculated - -	6	6
		„ inoculated - -	12	11
		Total - -	18	17

STATEMENT No. I.

TOTAL of NATIVE TROOPS and FOLLOWERS.

	Fighting Men. Number once inoculated.	Fighting Men. Number twice inoculated.	Followers and Families. Number once inoculated.	Followers and Families. Number twice inoculated.	Plague Attacks. Fighting Men. Among uninoculated. Seizures.	Among uninoculated. Deaths.	Among once inoculated. Seizures.	Among once inoculated. Deaths.	Among twice inoculated. Seizures.	Among twice inoculated. Deaths.	Followers and Families. Among uninoculated. Seizures.	Among uninoculated. Deaths.	Among once inoculated. Seizures.	Among once inoculated. Deaths.	Among twice inoculated. Seizures.	Among twice inoculated. Deaths.
Week ending 14th October 1898	637	—	328	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 21st „	1,012	—	828	—	1	—	—	—	—	—	2	2	—	—	—	—
„ 28th „	1,728	—	2,603	—	6	6	—	—	—	—	14	12	2	1	—	—
„ 4th November 1898	2,548	—	6,533	—	1	1	4	3	—	—	4	3	11	10	—	—
„ 11th „	2,854	—	8,112	—	—	—	8	5	—	—	18	16	12	9	—	—
„ 18th „	2,899	28	8,403	38	—	—	2	—	—	—	9	9	20	13	—	—
„ 25th „	2,134	739	8,056	730	—	—	8	6	—	—	5	3	3	2	—	—
„ 2nd December 1898	1,476	1,401	7,769	1,062	—	—	3	1	1	1	1	—	5	4	—	—
„ 9th „	944	1,933	5,739	3,098	—	—	1	1	1	1	6	6	12	10	1	1
„ 16th „	691	2,209	5,508	3,330	—	—	1	—	—	—	2	1	14	9	—	—
„ 23rd „	678	2,222	5,421	3,417	—	—	—	—	—	—	—	—	2	1	1	1
„ 30th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 6th January 1899	—	—	—	—	—	—	1	—	—	—	—	—	3	—	—	—
„ 13th „	—	—	—	—	—	—	—	—	—	—	—	—	3	1	—	—
„ 20th „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ 27th „	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
„ 3rd February 1899	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Total -	—	—	—	—	8	7	28	16	2	2	61	52	89	60	2	2

	Seizures.	Deaths.
Total among uninoculated - -	69	59
„ once inoculated -	117	76
„ twice „ - -	4	4
Total - -	190	139

Mr. P. R. Cadell, I.C.S.

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STATEMENT II.

Corps.	Strength.	Plague Seizures. Among uninoculated.	Among once inoculated.	Among twice inoculated.	Total.	Plague Deaths. Among uninoculated.	Among once inoculated.	Among twice inoculated.	Total.	Remarks.
A. Fighting Men.										
Q. O. Sappers and Miners	769	2	9	—	11	2	4	—	6	
2nd Madras Lancers	554	3	12	—	15	2	7	—	9	
1st Madras Pioneers	797	1	—	2	3	1	—	2	3	
17th Madras Infantry	780	2	7	—	9	2	5	—	7	
B. Followers and Families of Native Troops.										A. AND B.
Q. O. Sappers and Miners	1,651	6	9	—	15	4	3	—	7	Percentage of case mortality among uninoculated - 73·8
2nd Madras Lancers	1,298	7	15	1	23	5	10	1	16	" " once inoculated - 51·4
1st Madras Pioneers	786	—	5	1	6	—	—	1	1	" " twice inoculated 100·0
17th Madras Infantry	959	—	7	—	7	—	3	—	3	
Commissariat and Transport	1,272	5	10	—	15	3	6	—	9	Among Total 58·6
Total A. and B.	8,866	26	74	4	104	19	33	4	61	
C. Followers of British Troops.										C.
4th Q. O. Hussars	1,105	33	17	—	50	30	15	—	45	Percentage of case mortality among
J. Battery, R.H.A.	505	1	3	—	4	1	3	—	4	uninoculated - 93
21st F.B., R.A.	595	3	11	—	14	3	9	—	12	" " once inoculated - 88·4
25th F.B., R.A.	667	6	12	—	18	6	11	—	17	
Total C.	2,872	43	43	—	86	40	38	—	78	Among Total 90·7

In addition to the above, two European soldiers and a European child were attacked, of whom one died.
Two men of the Army Hospital Corps and one Recruit, 8th Madras Infantry, were attacked, of whom one died.
The above were all uninoculated.

	Attacked.	Died.	Percentage of Mortality.
The totals thus are among uninoculated	75	61	81·3
" " once inoculated	117	76	65
" " twice inoculated	4	4	100
Total	196	141	71·4

STATEMENT III.—NUMBER of DAYS AFTER INOCULATION that INOCULATED PERSONS were ATTACKED.

Number of Days after Inoculation	1	2	3	4	5	6	7	8	9	10	10 to 15.	16 to 20.	21 to 30.	31 to 40.	41 to 50.	51 to 60.	Over 60 Days.	Total.	Remarks.
Native troops	—	1	2	—	1	1	1	—	—	—	1	1	6	7	7	2	—	30	There is a discrepancy of two between the number of inoculates here shown as attacked, and the number shown in Statement II.
Families and followers of Native troops.	—	—	1	—	—	2	—	1	—	2	6	2	3	15	6	5	8	51	
Followers of British troops.	1	2	1	1	4	3	4	2	2	1	3	3	6	4	5	—	—	42	
Total	1	3	4	1	5	6	5	3	2	3	10	6	15	26	18	7	8	123	
	33																		

STATEMENT IV.—EVACUATION and SEGREGATION.

The following Corps segregated their contacts only:—

2nd Madras Lancers.
1st Madras Pioneers.
17th Madras Infantry.
Followers J. Battery, R.H.A.
Commissariat and Transport Followers.

The following evacuated their lines:—

—	Date.	Cases after Evacuation.
Q. O. Sappers and Miners - -	16th November -	10*
Followers, 4th Q. O. Hussars - -	17th November -	3
Followers, 21st F.B., R.A. - -	12th December -	3†
„ 25th F.B., R.A. - -	10th December -	3

The numbers of the contacts segregated are not known. Only two contacts appear to have developed plague, but it is not certain whether this is the whole number.

* The Sappers were encamped on their Parade Ground, close to their old lines, and to infected quarters.
† Two of these were officers' syces who lived partly at the bungalows.

The exact number of the military population is not known, as there are always a certain number of unauthorised inhabitants of the lines. Taking it, however, at the figure of the Census of 1891, namely 15,133, the following figures may be taken:—

Total Population of the Station by Census of 1891.	Estimated Deaths from Plague to end of February.	Percentage of Mortality to Population.
100,081	4,779	4·77

Total Civil Population.	Estimated Deaths from Plague.	Percentage of Mortality to Population.
84,948	4,638	5·46

Total Military Population.	Deaths from Plague.	Percentage of Mortality to Population.
15,133	141	0·93

Exact figures are, however, obtainable with regard to the fighting men of the native regiments. Their strength during the epidemic of plague was (*vide* Statement II. of the papers submitted) 2,900 inoculated men, in addition to eight uninoculated men who were attacked by plague, or 2,908 in all. Of these 25 died from plague, or 0·86 per centum.

In estimating the probable number of deaths among the total population, a fairly high death rate from causes other than plague has been assumed, and no account has been taken of the considerable exodus which took place among the civil population, which, if it could be accurately estimated, would show the percentage to be even more favourable to the military population.

The Principal Medical Officer thinks — in the Resident's opinion, with justice — that, considering the fact that the native troops were living in the close neighbourhood of localities which suffered severely from plague, the extremely small mortality from plague among them is a strong testimony of the efficacy of the inoculations that were carried out among them at an early stage of the epidemic.

I have not entered the figures of the uninoculated in the statements, because it is impossible to arrive at them accurately. All the people in the lines were supposed to be inoculated, with the exception of old women and people in a delicate state of health; but it is obvious that a great number must have remained uninoculated, especially among the followers of the British troops. I think so, because a certain number of cases have occurred which have been recorded as being among uninoculated persons, when everyone was supposed to be inoculated. The figures regarding the strength of the fighting men of the native troops may be taken as absolutely accurate.

25,139. Can you give me an example of that?—One example is in J. Battery, R.H.A. In the week ending the 9th December there was one case among the uninoculated, although the whole strength of the battery was supposed to have been inoculated on the 4th November. Similarly, in the 21st Field Battery, there were three cases occurring among the uninoculated in the weeks ending the 18th and 25th November and the 9th December, while the whole strength of the battery was supposed to have been inoculated on the 11th November. Similarly, in the 25th Field Battery, there were six cases among the uninoculated, although the whole strength of the battery was supposed to have been inoculated.

25,140. You conclude from this that there were more non-inoculated people than was known?—I think so; they did not succeed in inoculating the whole number, except among the native fighting men, and possibly among the followers of the native regiments.

25,141. In all these cases in which you put deaths as having occurred among the inoculated people, I suppose the fact that these people had been inoculated was verified?—Yes; it was entered in the medical officer's book, with the date. I should like to put in a chart,* showing the number of cases among the inoculated and uninoculated, and the number of inoculated persons week by week. I wish to state, as an indication of the efficiency of the inoculation, that the total mortality from plague among the fighting men of the native troops was only 0·86 per cent., whereas among the civil population it was estimated at 5·46 per cent.

* *See* App. No. LXXII. in this Volume.

(Witness withdrew.)

Mr. E. L. CAPPEL, I.C.S., recalled and further examined.

25,142. (*Dr. Buffer.*) You have handed in a statement concerning Hubli, giving the inoculated population, &c.?—Yes.

25,143. Comparing these figures with the figures* handed in by Captain Leumann we found the two did not agree. Can you give us some explanation of that fact?—The explanation of that is that Dr. Leumann, as he has stated in his evidence, found it necessary from time to time to correct the figures which were given to him by the Chief Superintendent and by the other officers concerned.

25,144. In what way did he correct them?—By further inquiry, and on several occasions the figures were rather materially corrected in that manner. Dr. Leumann has said that those corrections were communicated to me as Collector, but I have searched the files, and I do not find that such communications were made to me at all—at any rate, there is no record on the Collector's files at Dharwar. I only used the original figures, and he has put forward the corrected ones, and, therefore, those corrected figures will stand. There was another point brought forward in Dr. Leumann's evidence, which was that his figures and mine did not agree as to dates.

25,145. There is only a difference of three days, and probably that was the time that they took to reach you?—The reason was that Dr. Leumann's figures, and the figures of all the other officers concerned in plague duty, were required by me for the special purpose of a weekly report to Government, which had to leave my office, or at least to be made up, on Fridays. In order to get those figures in time, the officers reporting to me had to report on Tuesdays and that makes the three days difference.

* *See* App. No. XV. in Vol. I. and Question No. 3064.

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25,146. If you take your figures you will see you give an account of the plague as far as the week ending the 2nd of December, whereas Dr. Leumann only gives them to the 22nd of October. Must you not correct the other figures now, because we can only take Dr. Leumann's figures as far as the last date in his report?—There are no corrected figures. The figures that are given beyond that may be taken to be accurate. They are not corrected by anybody, and there is nothing to show that they require to be corrected.

25,147. But did not all the other figures require to be corrected up to the 22nd of October?—No, all the figures up to August were not challenged at all.

25,148. But from August?—From August Dr. Leumann made corrections occasionally.

25,149. I think he made corrections in all of them; is that not so?—Yes, but those corrections did not amount to anything very vital. There is a difference of about 3,000 in inoculated cases, which, considering that the total inoculations ran up to 40,000, will not vitiate any inferences to be drawn.

25,150. Then you have no further corrections to offer?—I have no further corrections to put forward.

25,151. Then we take Captain Leumann's figures, as far as they go, as being your own figures?—Yes. I put in a statement reconciling my figures with his, as follows:—

HUBLI.

Weeks ending.	Population for the Week.	Inoculated			Uninoculated.	Attacks in				Total.	Deaths in				Total.
		Once.	Twice.	Total.		Once inoculated.	Twice inoculated.	Total inoculated.	Uninoculated.		Once inoculated.	Twice inoculated.	Total inoculated.	Uninoculated.	
Up to June 17	47,427	2,323	531	2,854	44,573	Details of these corrected figures cannot be found.		1	123	124	—	1	1	106	107
,, ,, 24	47,082	3,368	2,220	5,588	41,494			2	28	30	2	1	3	22	25
,, July 1	47,485	4,487	3,956	8,443	39,042			1	37	38	1	—	1	29	30
,, ,, 8	46,537	5,057	5,420	10,477	36,020			4	52	56	3	3	6	55	61
,, ,, 15	46,518	5,974	7,289	13,263	33,255			8	58	66	4	2	6	34	40
,, ,, 22	45,240	6,565	8,959	15,524	29,716			13	100	113	1	6	7	82	89
,, ,, 29	43,809	9,386	10,311	19,697	24,112			21	145	166	6	9	15	100	115
,, August 5	43,707	10,016	12,660	22,676	21,031			22	169	191	7	9	16	140	156
,, ,, 12	42,768	11,339	15,845	27,184	15,584			37	317	354	5	14	19	272	291
,, ,, 19	40,441	10,265	19,491	29,756	10,685			69	350	419	30	31	61	386	447
,, ,, 26	39,400	9,671	23,262	33,033	6,367			66	446	512	21	20	41	371	412
,, September 2	38,210	7,569	26,547	34,116	4,094			32	393	425	8	20	28	328	356
,, ,, 9	38,382	6,798	28,671	35,469	2,731			47	261	308	11	23	34	227	261
,, ,, 16	38,408	6,381	30,911	37,292	1,116			55	153	208	7	40	47	138	185
,, ,, 23	38,408	6,567	31,638	38,205	937			35	106	141	11	44	55	106	161
,, ,, 30	39,315	6,820	31,872	38,692	603			28	76	104	4	16	20	58	78
,, October 7	39,500	5,258	33,963	39,221	279	4	11	15	41	56	4	10	14	40	54
,, ,, 14	39,600	5,217	34,527	39,774	200	3	17	20	14	34	3	15	18	18	36
,, ,, 21	39,953	5,286	34,763	40,049	200	—	6	6	11	17	—	6	6	11	17
,, ,, 28	40,453	4,196	35,040	40,236	217*	1	4	5	3	8	1	4	5	3	8
,, November 4	40,693	5,100	35,229	40,329	364	—	2	2	7	9	—	2	2	6	8
,, ,, 11	41,164	5,116	35,348	40,464	700	—	2	2	2	4	—	2	2	2	4
,, ,, 18	41,643	5,117	35,397	40,514	1,129	—	—	—	2	2	—	—	—	2	2
,, ,, 25	42,206	5,214	35,558	40,772	1,434	—	—	—	—	—	—	—	—	—	—
,, December 2	42,640	5,157	35,959	41,116	1,524	—	—	—	3	3	—	—	—	3	3
Average - - -	42,040	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total -	—	—	—	—	—	—	—	491	2,897	3,388	129	278	407	2,539	2,946

* The rising figures represent new comers.

	Percentage of*		Percentage of Deaths to Attacks in			General Rate.
	Attacks to Population.	Deaths to Population.	Once inoculated.	Twice inoculated.	Uninoculated.	
1. Dharwar - - - - - -	6*	4·4*	36·5	24·1	78·1	73·3
2. Hubli - - - - -	8·06*	7· *	82·9†	82·9†	87·6†	86·9†
	Percentage of Deaths (Plague) to Population.*					
— Dharwar - - - - - -	—	—	3·2	·07	9·01	4·4
— Hubli - - - - -	—	—	·3	· 6	6·04	7·

* Taken on average population, which is, for Dharwar, 21,808, and for Hubli, 42,040.

† These figures are not worth much. They arise from an unduly low proportion to the total inoculations and should not be generalised from. Also, there is the fact that many inoculations were done on persons already incubating plague. (*See* Dr. Leumann's Report, App. XV. in Volume I.)

	Attacks in		Deaths in	
	Dharwar.	Hubli.	Dharwar.	Hubli.
Once inoculated - - - -	115	491	42	129
Twice inoculated - - - -	29		7	278
Uninoculated - - - -	1,172	2,897	916	2,539
General - - - -	1,316	3,388	965	2,946

Mr. E. L. Cappel, I.C.S.

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25,152. I believe you have a statement to make with regard to the enormous number of deaths among the uninoculated during the last period?—Yes, this statement which was embodied in my evidence, showed that in the third week of September there were only 143 uninoculated persons, and that there were 99 attacks among those, giving a percentage of between 60 and 70 per cent. for one week. Those figures had been reported by me to Government in my weekly report, but I pointed out in those weekly reports, what is a sufficiently obvious thing, that percentages drawn on very small figures are unsafe, and that was eminently so in this case, because those figures turned out not to be right. By Dr. Leumann's corrected record, the figures for that week should be:—Uninoculated persons 937, inoculated 38,205, and plague deaths among the non-inoculated 106, and among the inoculated 55. The percentage works out for the uninoculated to 113 per 1,000 per week, which is very different to the percentage formerly given.

25,153. That is exceptionally high?—Yes.

25,154. How do you account for this very high mortality among the uninoculated?—I do not account for it at all. In my evidence formerly given I stated that the virulence of the disease was very great at that particular time, and in that particular part of the country, and that the villages adjoining Dharwar and Hubli, which were similarly situated, and, if anything, in a better sanitary position, and where no inoculation was done, suffered to the extent of from 30 to 50 per cent. in the course of from six to 12 weeks, whereas the Hubli epidemic lasted 22 weeks.

25,155. One hundred and thirteen per mille would kill everyone in the town in less than eight weeks?—But 50 per cent. in six weeks will clear it out in 12.

25,156. Have you any other villages or towns of the same size as Hubli, showing a mortality from plague equal to that?—No. I would like to point out that, taking Dr. Leumann's figures, they are very small to draw percentages upon, and the deduction is not a very safe one.

25,157. We had it in evidence before us from several people, that the uninoculated population in Hubli was greater than that given in Dr. Leumann's Report. It has been estimated by several witnesses as being about 5,000?—I very much question that. No officer concerned with those operations could say, with certainty, that a census of that kind is absolutely accurate. There must be a margin of error, seeing the conditions in which those things are taken in India. But to assert that the census was out to that extent appears to me to be a statement very wide of the mark. The plague census was taken in exactly the same way as the Imperial Census was taken.

25,158. When was the first census taken?—In October or thereabouts.

25,159. When did plague break out?—About that time. It was taken in exactly the same way as the Imperial Census was taken, that is to say, the houses were numbered, the town was divided into sub-divisions and wards, and a separate census paper was made out for each house. These papers were bound up in volumes, and constituted the record of each Supervisor and Superintendent, who went about with them daily in their hands. That was the first document on which the Supervisors and Superintendents worked. It was by these census records of each house that they tested whether people had arrived or had left, or were sick or had died. After the census was first made at the end of 1897, it was tested weekly during the operations by a corrected record being sent in for the purposes of that week's plague report.

25,160. Then you cannot account for that statement as given to us?—I think that statement errs very much on the side of exaggerating the error.

25,161. Is there anything else you would like to add?—I may say with regard to the discrepancy between Dr. Leumann's figures and my own, that the figures of incidence were never changed at all. They were his own figures, and there is no change to be made in them.

25,162. Do you put in maps showing the incidence of disease in Dharwar and Hubli?—Yes.*

25,163. (*The President*) Having regard to the Dharwar district generally, am I right in supposing that there has been a very remarkable amount of inoculation done in that district?—Yes, we have, up to date, inoculated nearly 100,000 people in the Dharwar district, nearly all of whom have been inoculated twice.

25,164. At what stage in the prevalence of plague was the inoculation commenced? Early or late?—Quite early in every case.

25,165. Am I right also in believing that there has been a very large amount of plague in your district?—Yes.

* *See* Appendices No. LXXIII. and LXXIV. in this Volume.

(Witness withdrew.)

Sardar Khan Bahadur Muhammad Yakub Khan.

SARDAR KHAN BAHADUR MUHAMMAD YAKUB KHAN called and examined.

25,166. (*The President.*) You are now on special plague duty in Bombay?—Yes.

25,167. When were you placed on this special duty?—On the 7th October last, in Bombay.

25,168. Previously to that you had been working in Karachi, I think?—Yes, on plague duty, but not immediately before that. Immediately before that I was Acting Deputy Commissioner in the Thar and Parkar district.

25,169. Were you on duty during both epidemics in Karachi?—Yes—the first being in 1897 and the second in 1898.

25,170. Will you describe the system which you found best suited for conducting plague operations?—Yes. My district there consisted of several villages of Musalmans. In each village I formed a committee of the leading members of the village, and conducted my operations through them, and with their co-operation.

25,171. What did these operations consist of?—Before I went there, there was opposition even to disinfection of houses, and to the segregation of contacts. In those days the sick were not removed to hospitals. After securing the co-operation of the Headmen, we arranged for segregation camps, and removed the contacts from the infected houses to the segregation camps and the sick to the sick camps. That was always done by the Headmen themselves.

25,172. What special advantages do you claim for your system?—The people were ignorant and excitable; through the Headmen they understood things better, and things went on more smoothly, and, I think, more quickly.

25,173. You got earlier information of plague cases, and were able more easily to remove the sick and the contacts?—Yes.

25,174. Was any evacuation of a large area attempted?—Yes, on a large scale. In the first year, three whole villages were moved into health camps one after another. That was arranged through the Headmen.

25,175. What was the population of each village?—In the first village it was 1,600. Half went away to the hills and the other half came into camp. The second village had 913 people.

25,176. They all went out?—Yes.

25,177. And the third village?—I have not the figures at hand now for the third village.

25,178. Was it smaller than either of the other two, or larger?—It was smaller than either of them.

25,179. Had plague already taken a strong hold in these villages before evacuation?—Yes.

25,180. In general terms, what was the result of the evacuation so far as the spread of plague was concerned?—With regard to the first village, we had no plague case in the camp after the first ten days. I say, from recollection, that there were only 18 cases in the first ten days.

25,181. How many cases had there been before evacuation in the first village?—There were about five cases a day before evacuation.

Sardar Khan Bahadur Muhammad Yakub Khan.

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25,182. How many days had that been proceeding?—Not less than ten days.

25,183. Now, with regard to the second village?—In the second village there were three plague cases only after evacuation. Before evacuation, we had two or three cases every day.

25,184. For how many days?—I should say for one week.

25,185. Now, with regard to the third village?—I have not the figures for that.

25,186. What is your opinion as to the value of evacuation in stopping an extending epidemic?—I am strongly of opinion that it stops it.

25,187. Did you have any experience in Karachi city?—My quarter formed part of the city. The people from Karachi city in the second epidemic camped outside in what is called the Trans-Lyari area. Half of that area was given to my charge. In all 30 voluntary camps were made by the people in my portion, and the population of that was 14,000. The other portion was given to another officer, and there were 11,000 people there.

25,188. Making a total of 25,000 all out at the same time?—Yes.

25,189. Had that a beneficial effect upon the spread of plague in Karachi?—Decidedly it had, I was watching each camp, and after ten days I did not find plague cases there. If there was any rare case found, I traced it to some infected people coming in without permission.

25,190. How long were the people kept out of their houses?—It varied slightly; on an average six weeks to eight weeks.

25,191. What was done with the evacuated houses before the re-admission of the people?—I was not concerned in that; it was done in the City Proper, but I know that there was an arrangement for general disinfection of all houses in the city. It was very thoroughly done.

25,192. Was it by chemical disinfectants?—Yes, under the supervision of medical officers specially appointed.

25,193. Were the houses opened up and unroofed?—Where it was necessary; not always.

25,194. What is your opinion of the duration of a plague epidemic if it be not interfered with?—I have not had experience of that.

25,195. If it be interfered with, what do you think is the general duration?—Four months.

25,196. That will depend upon how it is interfered with; you have already said it appeared to stop in ten days?—Yes, ten days for the people, but for the infected locality, I should say, two months. I would not see it re-occupied before two months.

25,197. Have you had any experience of plague affecting a second time a house in which it had occurred before?—Yes, my impression is that a large proportion of plague cases occur in those houses in which plague cases have previously occurred.

25,198. Is that after they have been vacated for several weeks, and disinfected?—No, I cannot say in those which had been vacated for several weeks, but in those which had been vacated for the ordinary period, namely, 10 days, and disinfected in the best manner laid down for us, cases did occur in the second epidemic.

25,199. Have you had any experience of inoculation?—Not much, except in respect of a portion of the population of two villages. In one village about 300 persons were inoculated, and I turned out about 200 from that village into a health camp when I found the village was getting infected.

25,200. The 300 people who remained were inoculated, and the 200 who were evacuated were not inoculated?—That is so. The 300 chose to get inoculated because they did not wish to leave the village. There were two cases of plague after inoculation, not before a fortnight I think.

25,201. Had there been many cases before evacuation?—Two per day.

25,202. Have you any other instance?—In another village 200 Memons were inoculated, they also got themselves inoculated because they did not wish to be turned out of their village. In that village there was about one case per day before the inoculations. After the people were inoculated there was no plague case in that village.

25,203. How many people were there in this village altogether?—These 200, and 100 more.

25,204. What became of the other 100?—I sent them to a health camp.

25,205. Before the inoculations?—Yes.

25,206. It is a similar case to the former one?—Yes.

25,207. In the case of plague becoming indigenous in a town of, say, 5,000 or 6,000 people, what would be your advice?—My advice would be to evacuate the town, if that were possible.

(Witness withdrew.)

Khan Bahadur B. B. Patel.

KHAN BAHADUR BOMANJI BYRAMJI PATEL called and examined.

25,208. (*The President.*) I believe you are a Justice of the Peace?—Yes.

25,209. What has been your relationship to the plague epidemic?—For the last two years I have been a volunteer in searching for plague cases.

25,210. (*Mr. Cumine.*) Are you a volunteer witness also?—Yes.

25,211. In what part of the city did your work lie?—In the Fort district.

25,212. From what period did it extend?—It commenced from March 1897.

25,213. Up to when?—Up to now.

25,214. To what class of the community are your observations chiefly confined?—Chiefly to the Parsees.

25,215. To how many of them?—Nearly 8,000. There are 360 houses in the block which is entrusted to me.

25,216. What proportion would that form of the total population in Bombay?—About one-sixth of the Bombay Parsee population.

25,217. How many plague cases among the Parsees have come under your immediate observation?—Nearly 125.

25,218. Have you noticed whether deaths among rats have generally preceded, or followed, attacks amongst human beings?—Preceded.

25,219. Is it, in your opinion, dangerous to continue living in a house where dead rats have been found?—Yes. I have explained the matter to several people, and told them not to live in houses where dead rats were found, but, notwithstanding, they live there. Within the last week I have seen plague cases where dead rats have been found.

25,220. Have you found that in a certain class of houses the death of rats is not necessarily followed by plague amongst human beings, and if so, in what class?—In some large and well-ventilated houses I have seen dead rats on the ground floor and on the upper storeys, and no plague cases have occurred, even on the ground floor.

25,221. Do you think segregation has had a good effect in Bombay?—It has had a very good effect among the Parsees.

25,222. How has that effect shown itself?—This year's mortality among the Parsees is about three-fourths less than the previous year.

25,223. Is there more segregation this year than there was before?—Yes. Nearly 2,500 people from the Fort have been segregated.

25,224. What do you call segregation?—The people live in the camp.

25,225. That is evacuation?—Yes. They have lived in camp on the Esplanade, on the Chowpati, and in six more other localities.

25,226. Voluntarily?—We persuaded some people to go out. Of course all did not go voluntarily. In several cases where dead rats were found, we persuaded them to go out.

25,227. Have you noticed whether plague cases this year occur sometimes in the same houses, or whether they occur in different houses?—Cases have occurred in the same houses, and I have seen cases occur even in the same rooms.

25,228. I suppose cases have also occurred to a large extent in the other houses and other rooms?—Yes, in other houses also.

25,229. Do you consider from what you have seen that plague is contagious?—No. Yet being a layman I cannot form an exact opinion, though I have seen people embracing, hugging, and kissing patients. Last week I saw in one family people embracing a patient.

25,230. What has the result been?—They have not been attacked.

25,231. Last week is rather recent?—I saw similar instances in January; but last week there was a plague case in my block, and I saw the people embracing the patient.

25,232. Have you had any considerable experience of Professor Haffkine's inoculations?—Yes.

25,233. How many people have been inoculated?—Amongst the Parsees 6,478 people have been inoculated since the year 1898, and there has been no death amongst them within the last six months from the date of their inoculations.

25,234. If there had been any deaths would you have heard of them?—Yes. We keep a register of deaths in our Towers of Silence. The register states whether the people are inoculated or not. It also gives the cause of death.

25,235. Has anybody examined that register to see to what extent inoculated people have died of plague?—All the particulars are in the register; whether they have died from plague or not, and whether they are inoculated or not.

25,236. Have you examined the registers often?—Yes.

25,237. You say over 6,000 people have been inoculated. That would be about one-eighth of the population. Then, even though the inoculated people died at the same rate as the uninoculated, you would expect to find in your register seven who died uninoculated to one who died inoculated, would you not?—Yes. Several people have died from plague one year, or nine months or eight months, after inoculation, but not within six months.

25,238. Have you worked out the figures from the registers?—No; from newspapers. I saw it in the Government Gazette. *Khan Bahadur B. B. Patel.* 14 Mar. 1899.

25,239. Has any case come under your notice where an inoculated Parsee has caught plague and died?—Yes; but the death has occurred after six months from the date of inoculation.

25,240. How many?—I cannot give the definite number, but I have seen some two or three inoculated cases having recovered.

25,241. (*Dr. Ruffer.*) How many inoculated people have died from causes other than plague?—A great many. Some have died of consumption, and some from fever and dysentery.

25,242. Can you tell us how many have died from causes other than plague?—No; I cannot tell you the exact number.

25,243. (*The President.*) Has your experience been chiefly amongst the Parsees?—Yes, amongst the Parsees only.

25,244. Do they dwell in rather better houses than the majority of the people?—Most of them dwell in better houses than the majority of the people. The 125 cases were mostly on the ground floors; and not on the upper floors.

25,245. When segregation was adopted this year, was it ever applied to people living in houses where there had been no plague cases, but which adjoined plague houses?—To people in houses in which plague cases occurred, or in which dead rats were found.

25,246. Not to adjoining houses?—*No.* We give people permission to go and live in the huts when dead rats are found, or when plague cases occur in their houses or in the neighbouring houses. When there are no plague cases, and when no dead rats are found, we do not give permission to the people to go and live in the huts.

25,247. So that the evacuation has been restricted to houses in which plague cases have occurred or dead rats have appeared?—Yes, so far as the Parsees are concerned.

(Witness withdrew.)

Dr. U. L. Desai called and examined. *Dr. U. L. Desai.*

25,248. (*The President.*) What are your qualifications?—M.B. and B.C.H., Victoria University, Owen's College, Manchester; L.R.C.P., L.R.C.S., Edinburgh; L.M., Edinburgh; L.F.P. and S.G., M.D., Belge, M.C.P., A.C.P., London; Consulting Physician Moah and Porwad Plague Hospital.

25,249. What is your opinion as to the cause of plague?—It is a manifestation of septicæmia by a specific virus in a filth diathesis.

25,250. In regard to the propagation of plague, what, in your opinion, are the chief causes of that propagation?—The chief cause is the infection by bacillus.

25,251. How is it spread or propagated?—By direct contact, by contagion, by inoculation from the earth, by aerial infection, by aqueous infection, by clothes and other fomites.

25,252. Have any of the lower animals got anything to do with it?—Yes.

25,253. What animals?—Rats, and other rodents.

25,254. Have you got any examples in which rats appear to have actually produced the disease in human beings?—I have seen one or two cases in which dead rats have been found in the houses, and the people living in the houses have vacated them at once, and then plague has broken out in the next house.

25,255. In the house without the rats?—Where the rats have not died.

25,256. How do you associate that contagion with rats if rats were not in the house in which plague occurred?—Before the rats came to that particular house where they died they must have been moving about; they do not stay in one particular locality.

25,257. These people might also have come in contact with plague contagion in other ways, might they not?—Yes, they might.

25,258. Have you anything to show that rats did it, anything more clear and definite?—No, except that I have observed plague invariably breaking out in houses not vacated after rats dying in them.

25,259. What is your opinion as to the origin; is it an introduction, or does it arise spontaneously?—From analogy, from cholera and other specific diseases, I think the disease can arise *de novo*.

25,260. The only reason for saying that is analogy?—Yes.

25,261. No fact in relation to plague itself?—No. It being a specific disease, it could not differ in its methods of origin and propagation from other diseases of the same class.

25,262. What are the most important predisposing causes of plague in your view?—Overcrowding, lowering of the vitality of the people by habitual derangement of health, as over fatigue, anxiety, habitual disregard of hygienic rules, diet, exercise, clothing, air, and water.

25,263. Everything insanitary?—Yes, both from a personal and a general point of view.

25,264. Amongst which things you place overcrowding first?—Yes. Overcrowding, and the pollutions of earth, air, and water resulting from it.

25,265. What about the exciting causes, or immediate causes?—Infection by a specific bacillus.

25,266. Has it come within your observation that any special classes of the community are more liable to plague than other classes?—The poorest, who live in damp filthy localities, are the most subject to this class of disease.

25,267. That is a new condition. You did not mention that before. That you distinguish from overcrowding?—Yes. They might act together or separately, overcrowding, filth, and dampness. Before plague broke out in Bombay, Poona, and Surat exceptionally heavy rains had fallen, increasing dampness and atmospheric humidity, besides the rise of subsoil water level.

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25,268. You think dampness in an open house might be a strongly acting cause?—Indirectly, because dampness will give a fit condition for the bacilli to grow in. A certain amount of moisture and heat are necessary for the growth of bacilli. Dampness supplies moisture.

25,269. Overcrowding you still keep in the first place?—Yes.

25,270. What communities are least liable to plague?—Europeans.

25,271. How do you explain their relative immunity?—By being removed from overcrowding and the causes of infection, in the first place; and in the second, by having more vitality in them.

25,272. What do you mean by vitality?—Capacity to resist the inroad of a disease. They are a better-lived class of people. Their nourishment is of a superior order to that of other communities that contract plague.

25,273. Is not that covered by what you mean by vitality?—Yes. Good nourishment means more vitality.

25,274. Are there any other causes?—The sanitary surroundings in which they live.

25,275. And that other great factor which you have referred to, overcrowding, has that anything to do with it?—Yes; it is much less amongst Europeans.

25,276. What do you think should be the plan of campaign against plague?—Battle against plague has to be waged not only as against a specific disease, but as against general causes of unhealthiness leading to lowered vitality of the masses, and consequent increased mortality. It will have to be a huge war against the continued forces of hereditary habits, religious prejudices, conserved customs, and extreme ignorance of the laws of personal, social, and public hygiene, which go to make up the social life of an Asiatic. It is to be a thorough meeting of the sanitary and medical needs of the country, by numerous compulsory enactments and institutions, which shall be bitter pills for the masses of India to swallow, and unless that is done, plague germs shall find fit nidus to grow, multiply, and cause ravages in various parts of India.

25,277. Therefore you think that a large improvement in the first place in the sanitary condition of the people is the fundamental reform required for diminishing plague epidemics; is that your view?—Yes.

25,278. What are the chief remedies you would propose against plague?—The chief remedies against plague are:—

Temporary.—Isolation of those attacked from the healthy, and removal of the inhabitants of the affected area to healthier localities.

Permanent.—For Bombay:—

1. To improve its drainage and sewerage. The most of the drains of Bombay are below sea level, some of it even below spring-tide low water mark, and nearly the whole of it too slightly elevated to admit of gravitation into the sea, at a distant point of outfall, and hence, improvement in the gradient is necessary.
2. An Act for the better housing of the people in Bombay, with a view to lessen the overcrowding in badly-constructed, ill-ventilated and ill-accommodated houses, and increase the responsibility of the proprietors of houses, that are let to lodgers.
3. Inspection of houses, as regards cooking, washing, sleeping, and other accommodations, and as regards walking barefooted on a filthy soil.
4. Necessity of a Rent Act, to control exorbitant rents by greedy proprietors.
5. Compulsory notification of infectious diseases, and to obtain this end, introduction of an Act for medical practitioners, qualified or unqualified, specifying the responsibility of such practitioners.

For Bombay and other Parts of India.

6. Food and Drugs Act.
7. A scheme to promote the knowledge of personal and General Hygiene among the inhabitants of India, as by instituting Degrees in Sanitary Science at Bombay, Calcutta, Madras, and Punjab Universities. To set a paper on this subject at the Matriculation and School Final Examinations, and make Sanitary Science a compulsory subject at the Indian Civil Service Examination.
8. To organise a Competitive Sanitary Civil Service for India.
9. A scheme for village sanitation and healthy water supply for human beings and cattle.
10. A scheme to supply better midwives for natives.
11. A scheme to direct the charitable instincts of the wealthy Indians to organiso a system of medical relief in the homes of the poor.
12. An institution to supply nurses for infants and invalids among the Hindus and Muhammadans.
13. A scheme to encourage cremation of dead bodies of men and animals.
14. To enforce burning of all excretions and secretions of human beings and animals suffering from Infectious Diseases, particularly in Hospitals.

25,279. What do you mean by "Specifying the responsibility of such practitioners" as bearing upon the treatment of plague?—The first point is that, unless a man knows differential diagnosis, he cannot properly diagnose whether a case is plague or any other disease. It has actually come under my notice that a case of gonorrhœal bubo has been diagnosed as plague, and sent to a Plague Hospital in my charge.

25,280. You do not exclude unqualified practitioners?—I want to exclude them; but at present they are practising in India, and consequently I cannot exclude them. If an Act for Medical Registration is passed in India, the best thing would be to have an Act for qualified medical practitioners.

25,281. To register the qualifications of those who possess them?—Yes, and to give permission to qualified and registered practitioners only to practise, the same as it is in England.

25,282. Do you think the country is yet ripe for such a large measure?—Yes, I think it is quite ripe for the occasion, particularly the large towns of India, as Bombay, Madras, and Calcutta, where Medical Graduates of European and Indian Universities abound. In a city like Bombay the Act would work very well, now that the plague is on, for it will help the authorities to get at the real extent and home of plague which lies hidden under lies, quackery, and superstition.

25,283. I do not refer to the practitioners themselves, but in so far as the lower population is concerned. Do you think they are prepared for a measure of that kind?—When suttee and infanticide were practised, the measures taken for their suppression had to be strong measures. The will of the people is not to be taken into consideration, but their welfare is to be taken into consideration, and I think the British Government will confer the greatest boon upon India if they tried how this Act for qualified practitioners would work—at least in the city of Bombay. Numerous untold blessings to the ignorant masses will spring from this source.

25,284. What proportion, do you think, of the people do not employ qualified practitioners?—About three-fourths.

25,285. What proportion, do you think, do not employ any practitioners whatever?—At present the people refrain from taking any advice at all. They are afraid, if a case of fever is attended by a medical man, that he will report it as a plague case, and that the person may be removed to the isolation hospital.

25,286. I do not refer to the present period, but prior to this scare about plague. What proportion had no medical advice—no doctor?—Almost one-fourth.

25,287. And three-fourths do not have qualified practitioners?—No. This three-fourths include those that do not take any medical advice.

25,288. But still you think that a measure which prevented other than qualified practitioners from practising could be enforced—could be brought into operation?—Yes; provided vaids and hakims of a certain intellectual and moral standing already practising be given special licenses as qualified vaids and hakims, and an examining board for future vaids and hakims be instituted under Government supervision.

25,289. You think it would be very desirable?—It would be very desirable.

25,290. (*Mr. Hewett.*) Do you know anything of any places outside the Presidency towns?—Yes. I have been in Surat and seen plague there.

25,291. Do you know anything about the feelings of Muhammadans in Northern India as regards the employment of vaids and hakims?—Yes.

25,292. What are their feelings?—The feeling is that they prefer vaids and hakims, but in places like the Punjab there are universities for vaids and hakims. The Punjab University has a scheme whereby it gives its qualifications to vaids and hakims after a certain source of study.

25,293. In European medicine?—No, in country medicine; but it is modified upon a European basis.

25,294. When you propose the registration of medical men, do you propose to register those who practise by the European system, or those who practise by native methods?—If a special examination is held for native medicines on the same lines as that of the Punjab University, they may be included as qualified practitioners. I would propose to register two classes of qualified practitioners, one practising the European system, enjoying greater freedom in the scope of the medical, surgical, and midwifery work to be performed by them, and with power to sign a certificate of death. The other a class of qualified vaids and hakims, whose sphere of work will be curtailed, so far as surgery, midwifery, and signing of death certificates were concerned. They might also be prevented from using certain poisonous drugs, as arsenic, aconite, mercury, morphia, &c. As the masses will realise the superior privileges enjoyed by the class practising the European system, the class of vaids and hakims will gradually diminish. I do not want to deprive the Hindus and Muhammadans of their vaids and hakims, as it partly is a religious question, but I wish to give them better vaids and hakims with some qualifications and a sense of responsibility, while practising a profession on which the life and death of a human being depends. I may mention that the question is apparently a complicated one, and is believed by many to be impossible of realisation, but I know for certain that the details are easy of arrangement; only that in the starting of this Act, vaids and hakims of a certain intellectual and moral standing already practising will have to be given licenses as qualified vaids and hakims without any examination, and a Board appointed under Government supervision to examine and grant qualifications as vaids and hakims in future.

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25,295. Do you agree with the opinion expressed by many European medical men who have appeared before this Commission that the people do not like to be treated for plague according to European methods?—I do not agree with that opinion. I have been practising here for the last three years, and I know that they appreciate and prefer European medical attendance if they can afford it. The only bar is the heavy fees charged by European medical men. A love for skilful European medical and surgical practice is increasing even among the ignorant masses.

25,296. Are they in the habit of charging fees for attending plague cases?—Not now, because the plague cases are mostly attended in the hospital.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

SIXTY-SIXTH DAY.

Wednesday, 15th March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Mr. C. H. CAYLEY, M.B., called and examined.

Mr. C. H. Cayley, M.B.
15 Mar. 1899.

25,297. (*The President.*) You are Master of Arts and Bachelor of Medicine?—Yes.

25,298. Have you an appointment here in connection with plague?—Not now.

25,299. You have had?—I was working in the laboratory with M. Haffkine.

25,300. As an assistant?—Yes.

25,301. (*Dr. Ruffer.*) You have made some observations on the presence of plague bacilli in the sputum?—Yes.

25,302. In cases of primary and secondary plague pneumonia?—Yes.

25,303. How did you examine the sputum in order to find the bacilli?—I dipped a glass rod in the sputum and inoculated a series of agar tubes with this glass rod, and immediately after inoculating the tubes, I covered them up from the light.

25,304. Do you find that an essential precaution?—I never found bacilli growing unless I did do that. Then the agar tubes were allowed to incubate for 24 or 48 hours, and from the colonies that developed fresh agar tubes, and also flasks of peptone broth, were inoculated.

25,305. Do you find the bacillus is often present in cases of primary plague pneumonia?—In all the cases I examined it was forming nearly pure cultures at first.

25,306. What is the sputum of plague pneumonia like at first?—A bright brick-pink and very glutinous, coughed up with difficulty. After a few days it gets looser and a darker colour, and as the case goes on it gradually becomes muco-purulent.

25,307. Do you find the number of bacilli increases or diminishes in the sputum?—It diminishes.

25,308. When does it begin to diminish?—In primary plague pneumonia, after the third or fourth day, they were distinctly less.

25,309. Most of the cases of plague pneumonia die?—Yes.

25,310. But you saw two cases which recovered?—Yes.

25,311. Did you make any examinations as to how long after the fever had subsided the plague bacilli could be found in the sputum?—Yes; I did not see either of these cases till after the fever had subsided.

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In one case it was 10 days after the fever had subsided that there was plague bacilli in the throat. There was no cough or expectoration.

25,312. Were you able to isolate the plague bacillus?—Yes.

25,313. And reproduce the disease in animals?—A rat was inoculated, and it died in 4½ days.

25,314. A rat inoculated with the sputum itself?—No, with ½ c.c. of an agar culture.

25,315. How do you know these cases were primary plague pneumonia if you did not see them?—I saw the doctor in charge, and got the history of the cases. They had been entered as plague pneumonia, and, in both cases, there had been consolidation of the lungs and no buboes.

25,316. What are the physical signs of primary plague pneumonia?—At first there are no signs pointing to the lungs at all. In the earliest cases I saw, there seemed to be no sign pointing to any particular organ at all. Then a cough developed, there was expectoration, and then I detected some consolidation of one of the bases.

25,317. Is the whole base affected?—No, only a portion.

25,318. It is a patchy sort of pneumonia?—Yes; in all the cases there seemed to be some distinct part where it started.

25,319. Does it affect both lungs or only one lung, as a rule?—In one of the cases both lungs were affected, but in most of the others it was one, and then there was general bronchitis.

25,320. The discharge from the mouth is sometimes extremely profuse, is it not?—Yes.

25,321. When do the secondary lung symptoms generally show themselves?—About the fifth or sixth day.

25,322. Is that the rule in every epidemic?—I do not think so. In Poona there were hardly any lung symptoms.

25,323. Have you made any observations in the present epidemic?—No, I have not.

25,324. You are referring to the epidemic of last year?—Yes; March, April, and May of last year.

25,325. The symptoms came on on the fourth or fifth day?—Yes; sometimes as late as the eighth day.

25,326. What physical signs did you find in the lungs?—Signs of acute bronchitis and patches of consolidation.

25,327. Did you ever find consolidation of the lung?—No; only a few patches where there was a little bronchial breathing, perhaps—no definite consolidation.

25,328. Did you ever notice signs of œdema of the lung?—In the later stages, when the patients were exhausted, at the back.

25,329. Did you notice signs of pleurisy?—No.

25,330. Is the sputum profuse in such cases?—Yes; it is fairly profuse, but not excessive.

25,331. Is not there a great deal of difficulty in bringing up the sputum?—Yes, there is.

25,332. The patients strain a good deal?—Yes.

25,333. Did you find the plague bacilli in such cases in the sputum?—In a fair number of cases.

25,334. In how many?—In 17.

25,335. Out of how many?—There were 43 after I had got the technique, and had worked out the best method for isolating the bacillus.

25,336. By cultures?—Yes.

25,337. In how many cases did you find it microscopically?—I found everyone of them had it, practically.

25,338. Did you find there were other bacteria present as well?—Yes.

25,339. What bacteria did you find?—A diplo-coccus was common at the start.

25,340. Did you find Friedlander's diplo-coccus?—I never went beyond the fact that there was a diplo-coccus.

25,341. Did you find strepto-cocci common?—Yes.

25,342. For how many days did you find plague bacilli in these cases?—As a rule, about a fortnight after the lung symptoms developed; but there was one case which was 28 days, three days after the temperature was normal.

25,343. Did you isolate it in that case?—Yes.

25,344. Did you find that the plague bacilli in such cases were virulent?—I inoculated three rats; they took three or four days to die, and the primary pneumonia case died after 36 hours.

25,345. I think in one case you found the plague bacilli for five days only?—Yes.

25,346. In 13 cases the plague bacilli were found in periods varying from 10 to 14 days, in one case 15 days, in one case 19 days, and in another case 23 days?—Yes.

25,347. (*The President.*) You have tested clothes for the bacillus?—Yes.

25,348. Will you be good enough to tell us what was the result of your testing?—I never succeeded in finding the bacillus in any clothes which I examined.

25,349. These clothes had been worn by plague patients?—Yes.

25,350. In any cases had they been removed from a corpse?—Yes.

25,351. You examined portions of these articles of clothing and did not find any?—That is so.

35,352. You have examined the perspiration, I think?—Yes.

25,353. With what result?—I never found the plague bacillus in it.

25,354. You examined the saliva?—Yes.

25,355. With what result?—I found the bacillus in ordinary bubonic cases occasionally. I examined five cases where the parotid or submaxillary gland was affected, and I found it in each case. In one case I found it in the secretion 10 days after the temperature had become normal; the glands were still enlarged, but they had not suppurated.

25,356. Ten days after the apyrexia, you found it?—Yes.

25,357. Is that the longest period?—Yes; I never found it in any other case after the temperature was normal.

25,358. Have you examined the urine?—Yes: I failed to find it in the urine.

25,359. Have you made a large number of examinations?—About 15.

25,360. At what stages of the illness of the patients?—At all stages.

25,361. Will you describe the process you followed for separating the bacillus if it had been in the urine?—I collected the urine direct from the bladder with a catheter and passed it into a conical vessel and allowed the vessel to stand covered up from the air. After it had been covered up for three or four hours I took a small drop from the sediment at the bottom and inoculated broth with that. Drops of this inoculated broth were added to tubes of liquid agar, and plates and rolled tubes were prepared from them. Numerous colonies of bacilli developed, but I never succeeded in isolating the plague bacilli.

25,362. You did not centrifugalise?—No.

25,363. What has your experience been with regard to fæces?—I examined two or three cases of fæces. In one case where the motions consisted of nearly pure mucus I managed to isolate the bacillus, but that was the only case.

25,364. Out of how many?—About five altogether.

25,365. Was this the only case you examined in which the symptoms were specially abdominal?—Yes.

25,366. Have you examined the epidermis of the tongue?—Yes.

25,367. With what result?—I examined about 20 cases and I found it twice in the fur at the back of the tongue.

25,368. At what stage of the illness?—The patients had been ill for some time—about 10 days.

25,369. They were becoming convalescent?—Yes. They still had fever and were ill, but they were out of danger.

25,370. Have you anything to add to what you have said as to the examination of buboes?—No. I could

always get plague bacilli from the buboes before suppuration had taken place, but after suppuration I never succeeded in getting it—at least, not from the pus. I got it from the part of the bubo which had not broken down. There was one case of bubo which had not suppurated, and the patient was convalescent and going about. I tried it, but I did not succeed in getting any bacilli from it.

25,371. What is the latest period in the disease in which you found any bacilli in the bubo?—In all the cases in which I found it the temperature was still high.

25,372. Within 10 days?—Yes. I did not make any special attempt to find out how long.

25,373. But the maximum period is about 10 days?—Yes.

25,374. I think you made some examinations of earth in different localities?—Yes.

25,375. In what localities?—In Poona and Bombay.

25,376. Where in Poona?—From the floor of infected houses and the graveyards of Poona.

25,377. What were the results?—I never found it.

25,378. Taking infected houses, how many have you examined?—About 30 or 40.

25,379. Did you take a mixed sample of different parts of each floor or only one part?—It varied. Sometimes, if a patient had been lying on a particular place, I took a part from there. If I did not know anything about the matter I took samples from different parts, avoiding the fire-place and where the light shone in.

25,380. At any rate, you included, in your examination, earth which you knew had been very close to the patient?—Yes.

25,381. You examined also the earth of graveyards?—Yes.

25,382. With what results?—I never could find the plague bacillus.

25,383. The floors which you examined were cowdung floors, were they not, in all the cases which you have referred to?—Yes.

25,384. Have you examined any dust in infected houses?—Yes.

25,385. Where did you collect it from?—I got it from all parts, from the ceiling and the walls, from niches in the walls, and from the sweepings from the floor.

25,386. What was the result?—The result was negative.

25,387. Were your examinations numerous?—Not with regard to the dust, particularly—that came in with the earth floors; I generally did some of the dust in the room when I did the earth floor.

25,388. That was a considerable number, apparently?—Yes; I suppose about 15 or 20 times I tried the dust.

25,389. Did you examine any of the hangings or the clothes in the room where patients had been living?—Yes.

25,390. What were they?—Mats in the room, hangings on the wall, and cotton or anything which I found lying about.

25,391. Did you examine any clothes?—Yes; soiled rags and anything I found left in the room.

25,392. Did you make a large number of examinations?—No; in about five or six houses.

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25,393. What was the result of that?—In one case I found the bacillus on a piece of matting.

25,394. Had that been hanging up?—It was actually hanging up when I found it, but I was told it had been used for the bedding of the patient who had died, and it was certainly soaked with the discharge.

25,395. Fæcal or urinal?—Urinal and the saliva from the mouth.

25,396. Not fæces?—No.

25,397. I think you have made some examination of the temperature of plague in the steam apparatus and of the penetration of that temperature to bundles of clothing?—Yes. At Poona a steriliser was used at the railway station. The clothes of each passenger were tied up tightly into bundles and put in. To effect penetration to the centre of these bundles sufficiently to kill the plague bacillus, we had to get a pressure of 15 lbs. to the square inch and keep it at least for a quarter of an hour.

25,398. How large was the biggest bundle?—2 feet by 2 feet 6 inches generally, in long bags.

25,399. And you found that penetration extended to the centre?—Yes.

25,400. How did you ascertain that?—I got glass capsules with living plague growths in broth and placed them right in the centre of the bundles: and after the exposure to the steam, fresh broth and agar tubes were inoculated from the contents of these capsules.

25,401. You did not ascertain the actual temperature?—No; there was no registering thermometer.

25,402. (*Dr. Ruffer.*) What disinfector was it?—It was a locomotive boiler. The steam was introduced from a stationary engine.

25,403. How big was the bundle?—Just the clothes of the people who came up; they were all sizes. I suppose the biggest I tried was 2 feet 6 inches by 2 feet. They could not touch the bundles at all for 10 minutes or a quarter of an hour after their removal from the boiler. When they had only 10 lbs. pressure, the bundles could be handled directly they were brought out, the heat did not penetrate. 15 lbs. pressure for 10 minutes was not sufficient.

25,404. That corresponds to what temperature?—I had not a thermometer, but I suppose about 220° F. or 224° F.

25,405. Have you ever examined the blood of patients for plague bacilli?—Yes, microscopically.

25,406. Not cultures?—No.

25,407. Have you ever found it in a case of plague which recovered?—No, not in any case; but I saw some slides of blood which Dr. Marsh had taken.

25,408. And the patient recovered?—Yes. Apparently, they were plague bacilli.

25,409. (*The President.*) In these pneumonic cases which you have referred to, did you ever search for the pneumo-coccus either in the primary or secondary cases?—I did not search specially for it. I was only looking for the plague, but there was a diplo-coccus constantly present in the secondary pneumonia which was only occasionally present in the primary pneumonia.

25,410. You could not identify that with the pneumonia coccus?—I thought the secondary pneumonias were primary pneumo-coccic infections. That is the idea I got from the examination of the sputum.

(Witness withdrew.)

Mr. Sorabji Manekji Damaun-Valla called and examined.

Mr. S. M. Damaun-Valla.

25,411. (*The President.*) You are a volunteer witness, I think?—Yes. I was nominated by the Collector of Surat.

25,412. Will you state to the Commission what have been your opportunities of observing plague?—When the first epidemic broke out in Daman I was called there, and I saw the people dying of plague.

25,413. Have you had experience elsewhere?—No.

25,414. (*Mr. Cumins.*) When did your experience in Daman begin?—At the beginning of the first epidemic in March 1897.

24,415 Up to what point did your experience last?—To the end of the epidemic in July 1897. Then there was a recrudescence in March 1898 up to June, and the third epidemic is now going on.

25,416. Have you had experience of all three epidemics in Daman?—Yes; I was there all the time.

25,417. I think you have come to speak about inoculation chiefly?—Yes.

25,418. Have you done any inoculations yourself?—I have.

25,419. How many people did you inoculate yourself?—About 200.

25,420. Did you keep a watch upon these people to see what happened to them?—Yes.

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25,421. Upon the whole 200?—Upon all those who were inoculated through me.

25,422. How many would that be?—About 4,000, inoculated at my expense—of course from time to time. In the beginning of 1897 I sent for Dr. Kalapesi. He came thrice to Daman through the courtesy of Dr. Haffkine and inoculated about 2,000 people, and about 200 by Dr. Poiares, and then the Government sent for him, and I have nothing to do with that. Then, again, I sent for Dr. Dubash. He inoculated 1,115 persons, including inoculation by me, and then again this year he has inoculated 397. This includes my own inoculations also. Besides this about 200 persons of my village of Katheria were inoculated by Dr. Fernandes.

25,423. In what month were the 2,200 people inoculated?—In March, April, and May 1897.

25,424. In what month were the 1,115 and 200 inoculated?—In April 1898, within nine and four days respectively.

25,425. And the 397?—Last month—February.

25,426. What part of Daman did all these three sets of people live in?—In Daman Proper, where I live Katheria, which belongs to me, and Kariwari, a group, of three villages. I have brought a map here which will show the position and topography of Daman.*

25,427. To what extent were you able to keep a watch upon these three groups of inoculated people?—I had about half a dozen agents who know all the people. Whenever the people were inoculated I used to send them round every day to ascertain how they were getting on, especially in the first year.

25,428. To 2,200 people?—Yes. They are all known to me, and I have every facility to make inquiries. Then it is a small area, about 1½ miles long and three-quarters of a mile broad. I, myself, used to visit them whenever I could, and I was all the more interested, as I had introduced inoculation and I did not know what effect it would produce.

25,429. What practical effect did it produce?—It had a wonderful protective effect. Those who were inoculated were protected from plague, and a very small ratio died—about two per cent.—whereas the uninoculated died in numbers—about 70 per cent. taking all the three seasons together.

25,430. How do you know how many of the inoculated died?—I had my servants, who were always going about. Then those who were inoculated had instructions to let me know if there was any sickness among them. Then I had my sepoys and the servants at the burial and burning grounds always from the beginning of plague, and they brought information if my other people failed to give it to me.

25,431. How did your subordinates and the sepoys at the burial grounds know whether certain persons were inoculated or not?—They inquired whether they were inoculated and what was the name, and reference was always made to the inoculation registers.

25,432. How are you satisfied that the answers they gave you were true answers?—Because whenever they were ill I used to know it, and gave them medicine as I gave to others also.

25,433. How did you know it?—Generally people came to me running whenever they got ill, and my men always used to go and inquire who was ill amongst the inoculated people. It is necessary to know, first of all, that Daman is a very small area, where it is not difficult to make inquiries, and then I, myself, and my men, know all the people. Then, owing to the cordon (British) which was very strict, nobody was allowed to go out of Daman. It was very easy to ascertain, especially in the first year.

25,434. Did you have a register kept in which each person's name was entered as he got himself inoculated?—Yes.

25,435. After the close of the first epidemic did anybody go round with this register in his hand to every house in the town and see with his own eyes whether the inoculated persons were alive or not?—Yes.

25,436. Who did it?—My men. I have about half a dozen men appointed for the purpose, and, as I said, I was specially interested and anxious in making inquiries during the first year in order that the preventive measure which was entirely a new one, and which I had introduced, may not prove injurious and bring a slur upon me. Then, again, Dr. Haffkine was very particular about the statistics.

25,437. Was this done at the close of the epidemic when people had ceased to die of plague?—No. Then there was no need, because my men who were at the burial grounds used to bring information.

25,438. Out of the first set of 2,200 people, how many got plague and how many died?—26 people died of plague up to May 1897, who were inoculated in the first season of the same year, when Dr. Lyons came to Daman for inspection. All the information was supplied to him by me.

25,439. How many got the plague and did not die?—That I have not got at hand. I have the register, but I have not taken out the figure.

25,440. Now with regard to the second lot; how many of those who were inoculated got plague, and how many died?—There were people who were inoculated in 1897 who died in 1898, and also who died in 1899. Up to date, yesterday, 83 persons have died, out of which 36 died during the first season.

25,441. Of those 2,200 inoculated in the first season, how many died in the first season, and how many in the second, and how many in the third? Then, as regards those inoculated in the second season, please tell us how many died in the second, and how many in the third season?—Of the 2,200 of the first season, 46 died in the first season (1897), 19 in the second season (1898), and two in the third season (1899). Of those inoculated in the second season (1898), 12 died in that season (1898), and four died in the third season. Fortunately, there has not been a single case of death among those inoculated in the third season (1899).

25,442. Was everybody who came to be inoculated in Daman inoculated, or did you reject some people because they were too old or too young?—Yes. Those who were too old, or those who had recent fevers or who had fever, or suffering from any other disease at the time, were not accepted. Then the old people, cripples, and small children under six months, and pregnant women, were rejected.

25,443. Did you observe whether inoculation had any marked effect upon the mortality from causes other than plague?—In the first epidemic, I did.

25,444. What was the effect?—After the epidemic had ceased the health of Daman was marvellously good, as the death register will show.

25,445. I am asking about the inoculated people. Had inoculation a markedly good effect upon them with regard to diseases other than plague?—I have not come to learn of any complaint, and when the inoculated people died, whatever they died of was registered. The register shows they did not die of any disease up to date, except the plague.

25,446. Amongst the 2,200 people inoculated in the first season, have there been, up to date, any deaths from causes other than plague?—Amongst the inoculated I have not found a death from any cause other than plague.

25,447. (*The President.*) I think I heard you say that after the epidemic had disappeared the health of the people seemed to be specially good?—Yes.

25,448. During the second epidemic, was there much sanitary improvement effected in the district?—I used to give disinfectants and fumigation. People had great faith in burning rosin and sulphur, and they were freely given to them.

25,449. Was there any special scavenging or cleaning of the place?—It was not what it ought to be.

25,450. Was there more done than before the plague?—Yes.

25,451. During the epidemic you specially attended to the scavenging?—Yes.

25,452. Did you open up many of the houses in which plague cases had occurred?—Not I; the Government did.

25,453. Were only the houses in which plague cases had occurred disinfected?—Yes. It is being done in a real systematic way this season.

25,454. Did they constitute a large number of the houses?—Yes.

25,455. Therefore, you had been specially active during the epidemic in improving the scavenging, cleansing

* Not printed in the proceedings of the Commission.

the place, and opening up a considerable number of the houses?—Yes. It is especially the case this season under Dr. Pinto, the Special Plague Commissioner.

25,456. And after the epidemic subsided the health of the population was greatly benefited?—Yes. If I am permitted, I should like to say that several cases were treated with living frogs. Living frogs were applied to the buboes. The first frog so applied died within five minutes, the second within 10 or 15 minutes, the third within half an hour, and so on; the fifth frog lived about two or three hours. I have even known it live five or six hours, and the patient found considerable relief.

25,457. From killing these frogs?—Not from killing, but from application. The colour of the frog was changed into a greenish-yellow when dead.

25,458. How are the frogs fastened on to the patient?—They were tied on to the bubo, on the abdomen side.

25,459. *With* a cloth?—No, without a cloth; they were put on and then bandaged. Some cut the frog transversely, and then applied it dead, and kept it on for some hours and then applied another. This is a sort of root (*handel'in*) which was applied by many people, and some found relief. The general treatment which the poor people applied was branding of the bubo. I have reason to believe that many escaped by mere branding than by any other treatment. Then there were one or two marvellous cures. A Parsee woman, while pregnant, got diarrhœa, and had it for a year and a half until she was inoculated. As soon as she was inoculated the diarrhœa disappeared on the third day without any medicine. The head Parsee priest, of Daman, is a gouty man, and used to get very severe attacks very often, lasting over weeks. After he was inoculated the attacks have become very mild and far between.

25,460. How many cases were treated with frogs?—About five.

25,461. Did they all recover?—Three recovered and two died.

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(The following letter was subsequently submitted by witness:—I produce a receipt which I have obtained from a native doctor, and which was said to be very efficacious:—

"Recipe for bubonic fever given by a native doctor (raid), Brahmachari Boa Raghranand, residing in Kandavady, Bombay, who has treated and cured hundreds of people with the following medicines:—

"*For External Application.*

℞:

"*Bhilama* (marking nut) cut into small pieces	1 lb.
"*Ius* (Incense or Crude Mastic) in coarse powder	1 lb.
"Wax, in pieces	½ lb.
"Oil of *Sarsi* (Pongamia Globra)	¼ lb.

"Mix together and distil. Apply the distilled oil or ointment as a plaster on the buboes, and ferment them with *Neem* tree leaves (Azadirakhta Indica) mixed with Ajawan and common salt.

"*For Internal Use.*

℞:

"Cow's urine "Juice of *Neem* tree leaves "Juice of green (*i.e.*, fresh) ginger	To be taken in equal parts.

"To be taken when there is fever or not. Dose, ½ oz. for adults once or twice a day. If the fever is very high, give thrice a day. When the fever is less, reduce the dose."

The aforesaid native doctor is well known in Bombay, has great experience of native herbs and medicines, and has cured some very serious diseases. He assures me that he has treated hundreds of cases of plague with the above medicines, and cured most of them.)

(Witness withdrew.)

Mr. SHRINIVASA RAU, M.B., recalled and further examined.

Mr. Shrinivasa Rau, M.B.

25,462. (*Dr. Ruffer.*) I believe you have made some observations on the samples of soil found at depths of 1,420 and 1,620 feet respectively in the Mysore mines?—Yes.

25,463. What sort of soil was that?—More or less pulverised rock.

25,464. Was it mixed with any organic material?—Yes.

25,465. Where did that organic material come from?—I believe it must have been brought in by the miners who went down.

25,466. You do not know whether the micro-organisms which you found there are due to the organic material which was brought in by the miners, or whether they were in the rock itself?—That is so.

25,467. What micro-organisms did you find?—Only four kinds of bacilli, three of which were spore-bearing, and one was non-spore-bearing, but it was motile.

25,468. Did you find anything else?—No.

25,469. I suppose the soil on which the coolie lines are built is full of all sorts of material?—Yes.

25,470. Did you find the plague bacillus?—No.

25,471. Did you find that cockroaches which were inoculated died of plague?—A cockroach which was experimented on died, but I do not think it died of plague. There was no moisture in the bottle in which it was kept, and it must have died of that.

25,472. (*The President.*) Why did you make experiments with cockroaches?—I was specially asked to do so to see whether there was any chance of their carrying the plague.

25,473. (*Dr. Ruffer.*) You fed some cockroaches on plague-infected material, but you did not find that it affected them?—No; at least, on the fifth day after I fed them on infected material they were quite well.

25,474. What are "cyanide tailings"?—Pulverised rock mixed with a solution of potassium cyanide.

25,475. Did you find any micro-organisms in that?—No.

25,476. Did you make any experiments as to the effect of fumes given off by blasting gelatine?—I sent my assistant to make them.

25,477. What did he do?—He simply exposed pure cultures of the plague bacillus to the fumes for five, ten, and fifteen minutes. He opened a cotton plug, and also opened a Petri's dish and exposed them to the fumes. I was not satisfied with the way in which the experiments were done, and I have not drawn any conclusions from them.

25,478. Did the plague bacillus die as a matter of fact?—No.

(Witness withdrew.)

(Adjourned to Friday, March 17th.)

At The Secretariat, Bombay.

SIXTY-SEVENTH DAY.

Friday, 17th March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX (*Secretary*).

Major J. Crimmin, V.C., I.M.S.

17 Mar. 1899.

Major J. CRIMMIN, V.C., I.M.S., recalled and further examined.

25,479. (*Mr. Hewett.*) Can you supplement the figures you gave us at your last examination regarding medical examination of the crews and passengers of ships proceeding from Bombay, first to ports out of India, and secondly, to ports in India?—Since my previous examination on 2nd December 1898, the Port Health Staff examined, up to 15th March 1899, 330 vessels proceeding to ports out of India. They carried a crew of 20,273 and 15,745 passengers. The number of vessels examined and proceeding to ports in India, including Burma, was 22,950. They carried a crew of 169,799 and 218,069 passengers. The inspections in the harbour from 1st January 1897 up to 15th March 1899 show that 51,213 incoming vessels, with a crew of 404,934 and 520,679 passengers, were examined, and that 110,351 outward bound vessels, with a crew of 930,448 and 962,573 passengers, were examined, making a grand total of 162,064 vessels of all sorts, with 2,858,634 souls as crew and passengers. The total outward-bound vessels since 1st January 1897 I have classified into (*a*) those going to Aden, Red Sea, and Europe; (*b*) those to ports out of India, other than Aden, Red Sea, end Europe; and (*c*) those going to ports in India.

	Total Number of Crew and Passengers who left for Aden, Red Sea, and Europe.	Number rejected.	Total Number of Crew and Passengers who left for Ports out of India, other than Aden, Red Sea, and Europe	Number rejected.	Total Number of Crew and Passengers who left for Indian Ports, including Burma.	Number rejected.
In 1897 - -	56,448	181	32,802	206	621,404	2,735
In 1898 - -	57,988	552	33,705	547	830,135	13,812
From 1st January 1899 until 15th March 1899 - -	18,711	107	9,118	139	282,750	6,532
Total -	133,147	840	75,625	892	1,734,289	23,279

Total number of outward bound crew and passengers - - -	1,943,122
Total number of rejected at the examinations - - - -	25,011
Total number of plague cases found among outward-bound crew and passengers - - -	243*

25,480. Can you give us information to show the number of persons you prevented from sailing on outward-bound vessels?—The number prevented from sailing on outward-bound vessels since 1st January 1897 up to 15th March 1899, is 840 to Aden, Red Sea, and Europe; 892 to ports out of India, other than the above; and 23,279 to ports in India.

25,481. How many of these people got plague?—The number of outward cases that we know of is 243. The total number caught at the outward and inward inspections, as well as in harbour craft up to date, is 374. The number of plague cases I have given do not represent the total number prevented from sailing, because in the early days we had no camps to send the rejected to. They were turned into the city, and lost sight of.

25,482. Does your examination, in your opinion, act as a deterrent?—Yes, very much. Nowadays we get very few fully developed plague cases. In the early days we got fully developed cases; but since the people found our inspections were so strict they would not run the risk of being detained at the examinations. A person may have a rise of temperature—99° or 100° F., and he or she is rejected and sent to a camp. If the temperature falls to normal he is let out. If not he is kept until we are certain that the fever from which he is suffering is not due to plague. They have an idea that we knew when they came from a plague-infected house, and that they would be detained if they suffered from fever.

25,483. Does the fact that you have discovered and stopped a certain number of persons who have subsequently developed plague while under your observation, taken with the fact that very few cases have developed after the ship has left port, lead you to infer anything as to the period of incubation?—It is very difficult to give the period of incubation; I have cases in my mind of men who came from non-infected ports, and who developed plague within two or three days after after arriving in Bombay. These men died. There was one the other day that came from London. He was a paid off crew of one of the P. and O. ships. Being paid off he was booked as a passenger, and he came in here on the 25th February and was dead from plague on the 1st March.

25,484. (*Dr. Ruffer.*) Was he a European?—No, he was a native. The only case of plague I have found in a European, in connexion with ship inspections, was the case of a postal official. He was born in this country.

25,485. (*Mr. Hewett.*) I want to ascertain whether you think that the fact that so few cases develop after your examination, when you turn out all the people who have fever, tends to show that the period of incubation is very short?—I believe that in the majority of instances it is from three to five days. That is the period I put it at. Longer periods may be given, but I believe they are, more or less, mild cases and are not detected in the early stages of the illness.

25,486. When you were under examination last, you said you did not disinfect the clothing and the effects of any people proceeding by these ships; do you do so now?—At present we disinfect the clothes and bedding and boxes of all native crews proceeding to all ports out of India, either directly, or by first calling at another Indian port, such as steamers going to Europe *vid* Karachi.

25,487. What is your method of disinfection?—What we do is as follows:—The new native crews are collected in the disinfection shed by some official from the shipping office who brings a copy of the Articles. Native crews from ships in the harbour are brought by one of the officers of the ship. Roll-call from the Articles takes place so as to make certain that we have the total number of native crew as well as their property. The shed is divided into two portions. In the larger portion, the crews' kit is sorted. The crew dress themselves in the cleanest clothing they have, and the remainder of their clothing and bedding is put through an Equifex stove, and subjected to saturated steam at

* This number is exclusive of 47 cases found on vessels lying in the harbour, and 84 which developed among people arriving from coast ports near Bombay. For detailed monthly figures, *see* App. No. X. in Volume I. and App. No. LXXV. in this Volume.

a pressure of 10 lbs. to the square inch. This pressure is said to give a temperature of 239° F., which is said to give absolute disinfection in the case of the most resistant organisms yet isolated. Clothes and bedding are kept in the stove for 15 minutes, and during that time they are subjected to three changes of steam. They are then dried for about five minutes with hot air. Boots and shoes and rain-coats are disinfected with a spray of perchloride of mercury of the strength of 1 in 1,000, or, if they are greasy, they are sprayed with live steam through a hose from the boiler. The crews' boxes are brushed inside and out, or washed, if they are very dirty. They are then rolled about in a large tub containing a solution of perchloride of mercury, 1 in 1,000. The kit and boxes are then passed into a second part of the shed, where they are packed, and are then conveyed to the ship under a Police escort. One of the European Sanitary Police goes on board to see that no bedding is stowed away in the forecastle, fore-peak, or other parts of the ship. Sometimes they say they have no bedding at all, but we make them find it somehow or other. The floor of the shed is then swept, and the sweepings destroyed in the furnace of the stove. I have a copy of the Rules which have been drawn up. They are as follows:—

RULES for DISINFECTION of KIT at PILGRIM SHED.

I. The boxes and kit of crews to be collected and placed in the southern half of the building.

II. The Officer in charge of the disinfection should see that the entire kit, clothes, and bedding, and all the boxes of the crew are produced for disinfection. This can be ascertained by having a roll-call from the ship's articles. Each man, as his name is called, should point out his property.

III. The officer in charge should detail one of the Sanitary Police officers to see that the forecastle has been completely emptied of all kit and bedding, and that kit has not been concealed in cupboards, forepeak, stokehold, or other places on board.

IV. All clothes, including those worn at the time, and bedding, should be passed through the stove.

V. Fifteen minutes should be given for disinfection with steam at a pressure of 10 lbs. The steam at this pressure will have a temperature of 239° F. There should be three changes of steam during the 15 minutes, and 5 minutes should be taken for drying with hot air.

VI. The following articles need not be put through stove:—Leather goods, books, velvet, silks, rain-coats, and such other articles which, in the opinion of the Medical Officer, it is unnecessary to disinfect, such as clean white clothes, ironed shirts, &c.

VII. Leather goods should be sprayed with perchloride of mercury, or, if greasy, steamed with carbolised steam.

VIII. The boxes should be brushed inside and out, and then disinfected with perchloride solution, 1 in 1,000. When this has been done, they should be moved to the north side of the shed to receive disinfected kit.

IX. The kit, when disinfected, should be placed in the north side of the shed, packed there and conveyed on board the ship under escort.

X. A certificate, showing the number of saloon, deck and engine-room crew, whose kit has been disinfected, should be sent to the office, so that it may be attached to the vessel's papers for the information of the Examining Medical Officers.

XI. Crew should be advised to wear shoes or boots when on shore, and should clean their feet on returning to the ship at all times.

XII. When the disinfection of kit is finished, the floor should be swept and the sweepings destroyed in the furnace.

(1.) In order to meet the letter and spirit of the Venice Convention, the crews may be examined in the shed while the kit is being disinfected. The names of any of them who have a marked rise of temperature should be taken down and sent to the office.

25,488. Have any cases of plague been detected recently on steamers going to Europe after their departure from Bombay?—No, I do not know of any.

25,489. A statement was recently made in the newspapers that one or two cases had developed on board the *Caledonia*: can you give us any information as to this statement?—At our examination, on the 19th November 1898, we found a man with fever. He was sent for observation, and the doctors in charge of the hospital reported that it was a case of plague. The information was telegraphed to Suez by Government, and on the arrival of the vessel at that port two native crew suffering from fever were removed from the ship. Reuter telegraphed, as an item of news, that they were plague cases. I wrote to Egypt for details of the cases, and at the same time asked for a list of plague cases imported from Bombay during the year 1898. The President of the Quarantine Board replied that neither of the men removed from the *Caledonia* could, in his opinion, be considered to have developed plague, and further that no genuine case of plague had been imported from Bombay during the year. I have the letter here and can read extracts from it.

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25,490. (*Dr. Ruffer.*) By whom is it signed?—It is signed by Dr. Cathcart Garner. He says: "The ship, "on arrival at Suez, was disinfected and allowed to "proceed through the canal in quarantine." He goes on to say: "The first of these cases which I have "described as 'slight,' was up and about the next day, "and the temperature normal. He had a small simple "gland only in the axilla." Then he describes the other, and says, "This case has been treated all "through as 'suspicious,' although considering the "absence of certain clinical symptoms together with "the absence of bacteriological confirmation, I am "inclined to believe it was not really a case of "plague."

25,491. (*Mr. Hewett.*) Have any cases of plague occurred on ships going from here to Rangoon?—During the present epidemic which commenced in December 1898, only one case of plague, as far as we know, has got away from Bombay on a vessel bound to any port outside the Bombay Presidency. This was a native cook on board the *Booldana*, which left this port on the 18th of January 1899. At the time of the inspection of the *Booldana* one of the saloon-crew—a native cook—was missing. It now turns out that the missing cook was at the time suffering from fever on shore and did not like to face the inspection. He died of plague on shore a few days after the vessel sailed. The man who developed plague on board after leaving this port was another native cook who we now find resided in the same house as that in which the first cook who died came from. The second cook, who had plague on board, was therefore a contact. That is the only case, so far as we know, that has got outside the Bombay Presidency during the present epidemic.

25,492. Has any case of plague got by sea from Bombay to Ceylon?—No, it was another of those cases reported by Reuter. We made inquiries, and we found he was a man who went by land from Bombay to Tuticorin. He embarked at that port for Colombo, and on arrival he was found to have an enlarged gland and fever. I presume the doctors segregated him as a precautionary measure so as to be on the safe side. It was admitted later on in the newspapers that it was not a case of plague. The man did not die.

25,493. Have you heard this from Ceylon?—Yes; I hand in a copy of the letter from the Port Surgeon, Colombo, saying that it was not a plague case, as follows:—

"Port Health Office, Colombo,
25th February 1899.

"SIR,

"I HAVE the honour to acknowledge your letter No. 307, of 1899, dated 14th February, and to inform you that the case referred to occurred at Galle, and has been officially pronounced to be not one of plague. The patient, Carolis Jayesuria, travelled to Ceylon by way of Tuticorin, and passed through Colombo after disinfection. He was treated at Tuticorin for venereal disease, and the glands of the groin had evidently enlarged sympathetically.

The Port Health Office,
Bombay."

25,494. Is there any trade between the port of Bombay and Madagascar?—There has been some trade, apparently. I find that the last steamer which left Bombay for ports in Madagascar, either directly or by first calling at an intermediate port, sailed on the 9th of August 1897. She had a doctor on board, and during the voyage one death took place. This is certified in the log-book to have been due to paralysis, 41 days after leaving Bombay, and after an illness of 30 days. As far as we know plague broke out at Tamatave, in November or December 1898, that is 15 months after the last steamer left Bombay for

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Madagascar. I have a special report on the subject drawn up by Dr. Evans of my staff, which I hand in.*

25,495. Can you give us any facts about plague on the *Bhundara*?—The agents of the *Bhundara* say there were seven cases of plague during the voyage, of whom five died, and in addition there was a death certified to be due to acute lobar pneumonia. The first death took place on the 16th December 1898, the day after leaving Karachi. It took place among the coolies from some part of the North of India. There were no cases among the crew who left Bombay, and there was no illness of any kind resembling plague among the crew from the time they left Bombay until they returned to India *viâ* Colombo.

25,496. You have ascertained that from the agents?—Yes, and I hand in a copy of the log-book of the vessel, as follows:—

* *See* App. No. LXXVI. in this Volume.

VOYAGE No. 121.

COPY of OFFICIAL LOG, S.S. *Bhundara*

(See Note at end of Copy of Log Book.)

Date.	Entry.
16.12.98 5.30 P.M.	1. A railway coolie named Alla Ditha died from hyperpyrexia, and was buried at 8.5 p.m. by his co-religionists. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
20.12.98 6 A.M.	2. A railway coolie named Navab died from acute lobar pneumonia, and was buried at 8.45 a.m. by his co-religionists. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
20.12.98 10 A.M.	3. A railway coolie named Essa died from uncertain causes, whether cholera (sporadic) or plague, symptoms pointing to either or both, more towards the latter, and was buried at 10.45. a.m. by his co-religionists. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
20.12.98 10.30 A.M.	Effects of Essa (deceased) were destroyed. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
20.12.98 11 A.M.	After burial of Essa, the two cabins set aside for the hospital in the port alleyway, and one other second-class cabin next thereto, were thoroughly washed out, fumigated, and disinfected. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
21.12.98	4. A railway coolie named Jalal Deen died. Cause of death uncertain, whether cholera (sporadic) or plague, symptoms pointing to either or both, more towards the latter, and was buried by his co-religionists at 10 p.m. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
21.12.98 10 P.M.	Effects of railway coolie Jalal Deen were destroyed. Signed—J. E. SYLVESTER, Doctor, P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
23.12.98 9.10 A.M.	5. A railway coolie died, Feroz Khan. Cause of death plague, and was buried at 9.45 a.m. by his co-religionists. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
23.12.98 9.50 A.M.	Effects of Feroz Khan (deceased) were destroyed. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
24.12.98 6 A.M.	6. A railway coolie named Maula Dad died. Cause of death plague, and was buried by his co-religionists at 6.25 a.m. Signed—J. E. SYLVESTER, Doctor, P. H. STUNT, Chief Officer, A. E. STEBBING, Commander.
24.12.98 6.25 A.M.	Effects of railway coolie, Maula Dad (deceased), were destroyed. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
24.12.98	After the burial of the above, the cabins used as hospital were washed out with carbolic acid solution, and all bedding destroyed. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
28.12.98 1.30 P.M.	Fumigated No. 1 'tween deck with tar and sulphur, all ports, ventilators, and hatches closed whilst under fumigation for two hours. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
29.12.98 2 P.M.	Fumigated No. 2 'tween deck for two hours with tar and sulphur. Ports, ventilators, and hatches closed whilst under fumigation. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
30.12.98 2 P.M.	Fumigated 'tween deck alleyways with tar and sulphur for two hours. Ventilators, ports, &c. closed whilst under fumigation. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.

Date.	Entry.
31.12.98 2 P.M.	Fumigated No. 3 'tween deck for two hours with tar and sulphur. Ventilators, ports, and hatches closed whilst under fumigation. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
1.1.99 2 P.M.	Fumigated No. 4 'tween deck for two hours with tar and sulphur. Ventilators, ports, and hatches closed whilst under fumigation. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
4.1.99 11 A.M.	'Tween decks and alleyways washed with a solution of Jeye's fluid and whitewash all over the deck and three feet up the sides fore and aft. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
4.1.99	Lascars' and fireman's forecastles washed with Jeye's fluid and quicklime solution. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
5.1.99 2 P.M.	All flooring in the first-class saloon, also ship's bilges, washed with a solution of Jeye's fluid and quicklime. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
1st to 5th January 1899.	All clothes, bedding, and effects of coolies in No. 1 'tween decks (where all but one of the cases occurred) were soaked into a hot solution of corrosive sublimate for several hours. The coolies themselves were made to bathe in a similar solution. The plague attendants segregated for a few days, and after the necessary actions being carried out, were allowed to mix themselves up with the others. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
6.1.99 9 A.M.	A fracas occurred amongst the deck passengers, in which two of them were injured about the head. One of the offenders, who was caught red-handed, was tied up and kept on water only during the day, under the supervision of the Commander. He was released at 5 p.m. The injured were attended to by the Surgeon, one being retained in hospital for treatment, and the other, after having his wounds dressed, being discharged. Signed—P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
18.1.99	Paint work on upper deck. Saloon and second-class cabins all scrubbed round with carbolic powder. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
20.1.99	Boats used for landing passengers scrubbed and disinfected with carbolic powder. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
21.1.99	Crews' bedding and effects exposed to the sun's rays for six hours this day. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
22.1.99	Crews', passengers', and ship's dirty linen put into the port and starboard cutters and soaked in a solution of corrosive sublimate, as ordered by Health Authorities, to enable the ship to get pratique. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
22.1.99	Washed the 'tween decks, fore and aft tops, sides, and deck with corrosive sublimate, as per above orders. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
22.1.99	Put corrosive sublimate into all the bilges and pumped them out fore and aft. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
23.1.99	Took the linen out of soak and dried all during the day. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander
24.1.99	Destroyed by fire 40 bundles dry fish marked a.m. or c.a.m. under instructions from the Port Authorities. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer. A. E. STEBBING, Commander.
25.1.99	Destroyed by fire the following packages, under instructions from the Port Authorities, being rat-eaten :— A.M.J. - - 3 Bags Indian Corn. " - - 3 Bags Jawaree. B.A.K. - - 1 Bag Jawaree. E.A.K. - - 1 Bag Jawaree. Signed—J. E. SYLVESTER, Doctor. P. H. STUNT, Chief Officer, A. E. STEBBING, Commander

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The Medical Officer's Register shows six deaths from plague and two recoveries according to the following extract from the Register of the *Bhundara* on the voyage from Bombay to East Africa, *viâ* Karachi:—

No.	Names.	Disease.	Remarks.
3	Alla Ditta	S. Plague	16th. Died.
4	Nawab	S. Plague	16th. Died 20th.
5	Esa	Plague	19th. Died 20th.
6	Jalal	Plague	21st. Died 21st.
7	Feroz Khan	Plague	23rd. Died 23rd.
8	Mooladad	Plague	24th. Died 24th.

Besides the above, two more railway coolies are shown to have been admitted suffering from plague on the 25th December, Surbar Kutal, temperature 104·2; and Khuda Bux, temperature 103·4. Both had tender inguinal glands, and both recovered.

25,497. So that all the cases occurred among the coolies?—Yes, all occurred among the coolies, none of whom had left Bombay. The first death, as I say, took place on the 16th December 1898, the day after leaving Karachi. The second death occurred on the 20th December, the third on the 20th, the fourth on the 21st, the fifth on the 23rd, and the sixth on the 24th of December.

25,498. Do you wish to say anything with regard to some previous evidence which has been given here about the discharge at Mandvi in 1896 of the cargo of a ship laden with wet grain?—Dr. Weir, in his evidence on the second day, refers to a ship laden with wet grain, and states that notwithstanding his protest, the grain was landed and stored at Mandvi, and that a large number of rats died.* I remember the ship very well. She was the *Knight Companion*, which returned to Bombay after meeting with rough weather in 1891. The agents reported that the grain cargo was damaged and stinking badly, and wished the Port Health Officer to condemn it, apparently for insurance purposes. We stated that we had nothing to do with damaged cargo, and had no power to condemn it, and suggested, if it was stinking, that it would be advisable to send it out to sea on an ebb tide. The agents then consulted the Municipal Health Officer, and afterwards, presumably with his knowledge and permission, sent the grain cargo into the city. It would appear that the Municipal Health Officer has, or had, no power to order the destruction of bad or damaged food-stuffs unless actually exposed for sale as human food. Most of this cargo, I remember, was boiled down to make size of for stiffening piece-goods.

25,499. (*Dr. Ruffer.*) How do you ascertain the temperature in your steam sterilizer?—It is guaranteed by the constructors.

25,500. Have you ever made any comparative experiments?—No. I do not think there is an electric signal thermometer available in India. The results of the experiments showing the temperature at various pressure are given in a book of instructions sent with the sterilizer.

25,501. Yo do not take the temperature at each disnfection?—No; it is impossible, unless we have a patent signal thermometer, which I understand are very liable to get out of order.

25,502. (*Mr. Hewett.*) Is there anything else you wish to bring before our notice?—I understand some people are rather sceptical as to the way in which we carry out harbour inspections, and the success which has attended them. I should be delighted if the Commissioners would give me an opportunity of accompanying them around, so that they can verify for themselves what is done.

25,503. Have you any facts to show that certificates of inoculation are tranferred from person to person?—We have come across certificates, occasionally, where the description in the certificate does not correspond with the person presenting it.

25,504. Can you give specific instances of this?—As a specific instance, I remember one case which was brought to the notice of Government in connection with another matter. The card showed that Janki Dhakoo, a woman, age 40, was inoculated on 15th February 1899. The card was presented on the 20th February by a lad of not more than 17 or 18 years of age.

25,505. Will you please give us the number of deaths that occurred in 1895 and 1896 on board ships coming to Bombay from Hong Kong, with details of each case of death that occurred?—I cannot give details in those years, except for part of 1894, when plague was epidemic in Hong Kong. I have the counterfoils of the pratique book for 1894, which showed that 11 vessels arrived during the time that restrictions were in force against arrivals from Hong Kong, with a total of 1,269 crew, and 342 passengers from Hong Kong between the 29th June and 25th September 1894. During the voyage, three deaths occurred, and none of the persons who died came from Hong Kong. It is stated on the counterfoils of the pratique book, that many of the 11 vessels refused to take native passengers from Hong Kong. The log-books of six of the ships are filed in the Bombay Shipping Office, and the following is the history of the three cases who died:—

Case I.—The *Clyde* left Hong Kong on 2nd August, arrived Bombay 19th August. Mohamed Abdulla died from malarial fever on 17th August. He was transferred at Colombo from the s.s. *Shanghai*, which was on a voyage homeward bound from the East.

Case II.—The *Rosetta* left Hong Kong 16th August, arrived Bombay 3rd September. Bellal Jeewa died on 2nd September from beri beri. He was transferred at Colombo from the s.s. *Australia* which was on a voyage homeward bound from Australia.

Death 3.—The *Rohilla* left Hong Kong on 13th September, arrived Bombay 1st October. Abdulla Sallim died on 27th September from pneumonia. He was transhipped at Colombo from the s.s. *Mirzapore*, which was on a voyage outward bound from London to Calcutta.

The above three deaths had been certified to by the Surgeons on board. All the 11 vessels had doctors on board, with the exception of the *Kong Bing*. This latter vessel had no passenger leaving Hong Kong or on arrival at Bombay.

The above information and the fact that none of the intermediate ports became infected is against the hypothesis that plague was imported into Bombay from Hong Kong by human agency.

25,506. A case, supposed to be plague, has just occurred in a man who has arrived in a ship from Hong Kong, and is at the Modi-Khana Hospital. Will you please let us have particulars about that case, including the following, viz.:—

(1) When the ship in which the man came left Hong Kong;
(2) Where it touched;
(3) When it arrived here;
(4) How long the man was reported ill before arrival;
(5) Whether there was a doctor on board or not;
(6) Whether the man's illness was noted in the log-book or not; and
(7) How the case has been diagnosed to be plague?

—(The following particulars were supplied later by witness):—The following is a statement of information obtained from the Captain of the *Bormida*:—

Questions.	Answers.
"1. When did the *Bormida* leave Bombay on the last occasion, and for what ports?	She left Bombay on 28th January 1899 for Singapore and Hong Kong.
"2. Was her native crew's kit disinfected before leaving Bombay?	No. There was no such rule in force at the time.
"3. What crew and passengers did she take with her on the 28th January 1899?	Eighty-four crew and 20 passengers.

* *See* Question No. 996.

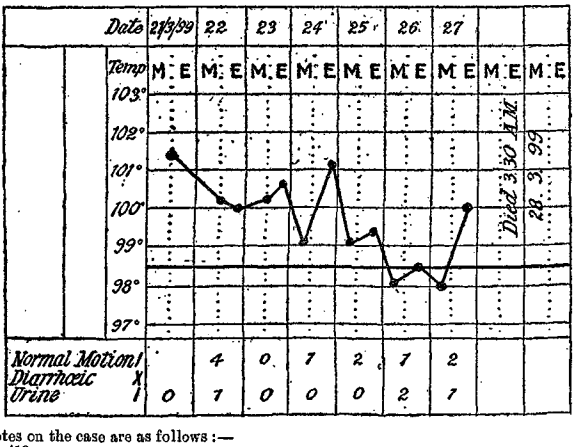
Questions.	Answers.
"4. What illness did the crew and passengers suffer from between Bombay and Hong Kong?	None.
"5. When did the *Bormida* arrive at Hong Kong, and how long was she at that port?	On 24th February, and remained there for four days.
"6. When did she leave Hong Kong for Bombay, and with what number of crew and passengers; giving the nationality to which they belonged?	Left on 28th February with the same number of crew, and with 366 passengers Chinese, including two Europeans.
"7. What ports did the vessel touch at between Hong Kong and Bombay, giving dates?	She touched Singapore on 6th March and left on the 9th. She touched Penang on the 11th morning, and left in the evening the same day.
"8. What illness did the crew and passengers suffer from on her voyage to Bombay from Hong Kong?	None whatever.
"9. When and where was the Chinaman cook Kwoknam shipped?	From Hong Kong.
"10. Was he examined before the vessel sailed from Hong Kong, and by whom?	Yes, he was examined along with others by the Health Officer of the Port.
"11. Was any medical examination of the crew and passengers made by the Port Health Authorities at Hong Kong, and on what date?	Yes, on the 28th February, the day of sailing at 11 a.m.
"12. On what date did Kwoknam commence to suffer from fever?	The first notice of his illness was made by the ship's doctor on the 21st March.
"13. Was he on shore at Hong Kong, and if not, had he an opportunity to go on shore if he wished?	He was, of course, on shore, because he came on board from Hong Kong, replacing one Chinaman in service on board.
"14. What cargo did the vessel take in at Hong Kong?	Sugar, camphor, chinaware from Hong Kong, and planks, rattens, tin, and coffee from Singapore and Penang.
"15. Did any rats die during the voyage?	None.

Bombay,
24th March 1899."

G. DELAYN,
Commander S.S. *Bormida.*

The Italian s.s. *Bormida* left Hong Kong on 25th February 1899, touched at Singapore 6th March, Penang on 11th March, and arrived at Bombay on the evening of 20th March 1899. Two days before she left Hong Hong a Chinaman named Kowk Nam was shipped as a cook. There was a medical practitioner on board, but no reliable history can be obtained about this Chinaman cook, and no entry of his being ill was made in the log-book. On inquiry on board some of the Chinamen said that the cook had slight fever for two days, and some said for seven days, while others said he had buboes from the time he left Hong Kong. It could not be ascertained if the man was in the habit of smoking opium to excess. On arrival in Bombay the man's temperature was 101·4° F., and he had enlarged glands in each inguinal region as well as an old sore below the navel. He became delirious on the 21st March, and was taken first to a non-plague hospital, where he was refused admission. He was then admitted into the Modi-Khana Plague Hospital, where the case was reported as one of plague. A copy of the man's temperature chart is as follows:—

Name, Kwok Nam; Sex, Male; Age, 30; Caste, Chinese; Occupation, Cook.



The clinical notes on the case are as follows:—

R. No. 2,412.
Name, Kwok Nam.

Date, 21.3.99.

Age.		Disease.	Duration of Disease.	Occupation.	Locality of Residence.	Caste.
Years.	Months.					
30	—	Plague. 1 bubo L. groin, 1 bubo R. groin.	7 days -	Cook - -	S.S. *Bormida* -	Chinese.

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Clinical notes—*cont.*

Date.	Symptoms.	Prescriptions.
—	Admitted into the hospital with fever and gland in both the groins. The patient is delirious and violent. Pulse is weak and frequent. Has an ulcer over the abdomen. The gland in the left groin is larger than the right, it is very tender. The relative of the patient says that he is suffering from fever for the last 7 days, became delirious this morning. The duration of the gland and ulcer is unknown. Came from s.s. *Bormida* from Hong Kong.	℞ Mist. Strych. ℥ iv. Sig. ℥ i every 4 hours. ℞ Morphia grs. ½. Liq. Strych. m. v. Fiatinjectio. 6.40 p.m.
22nd	Is delirious, but less than last night. Gland in the left groin is hard and prominent. Tongue is red at the tip. Pulse weak and quick. Culture taken by Dr. Liston from bubo in left groin. This culture showed a pure growth of bacilli pestis.	22nd. do.
23rd	Is quiet. Right bubo more enlarged. Culture taken from an incision near the ulcer.	23rd. do.
24th	Slept fairly, is conscious, pulse frequent and fairly strong. Tongue is red at the tip, coated at the back. The ulcer is drying. Cut over the left gland is ulcerated.	24th. do.
25th	Is quiet. Pulse fairly strong. Slept fairly. Tongue is coated. Eyes are injected.	25th. do.
26th	Is quiet. Ulcers are drying. The gland in the right groin getting soft. Tongue coated.	26th. do.
27th	Is weak. Does not take nourishment properly. Pulse soft. Died 3.30 a.m. 28.3.99.	27th. do.

It will be seen from the chart and notes that the temperature fell to 99° on the 24th, and that he was reported to be conscious. As the case was rather a peculiar one, I asked the Senior Medical Officer to have a bacteriological examination made. This was done on the 22nd and 23rd March, and it was reported that plague microbes were found. The bacteriological report is as follows :—

"Bacteriological and Clinical Report on Chinaman from Hong Kong, landed in Bombay 21st March 1899 suffering from Fever.

"On 22nd March I received instructions from Dr. Wilkins to make a bacteriological examination of the case of a Chinaman who had come from Hong Kong suffering from fever, and who was then lying at the Modikhana Plague Hospital.

"I saw this patient on the afternoon of the 22nd March. He was then delirious and talking in some unknown language and in broken English. His speech was not slurred or stuttering. His pulse was rapid, large, but soft. The tongue was flabby, coated with a thick white fur. The conjunctivæ were not injected. Temperature in axilla 100·2.

"Just below the umbilicus occupying the middle line but somewhat more inclined to the left side was an ulcer about ¾-inch broad by about 1¼ inches long (the longest diameter being vertical). The centre of the sore was occupied by a black slough; the edge of the sore was slightly elevated and infiltrated, and of a red colour. The infiltration did not extend for more than half an inch from the edge of the ulcer. In either groin an enlarged gland could be detected, largest on the left side. An incision with aseptic precautions was made into the gland in the left groin and with a platinum needle, agar tube cultures were made.

"The patient was again examined on the 23rd. Delirium was not so marked, he was weaker and the glands in the groins were decidedly larger, otherwise his condition was much as before. An incision was made into the infiltrated area at the side of the ulcer in the abdominal wall and agar tube cultures and blood films prepared therefrom. The blood films when stained showed one or two bacteria morphologically resembling plague bacilli.

"On 24th, an abundant growth was evident in the agar tubes obtained from the bubo on 22nd, the characters of the colonies, their rate of growth, and microscopical specimens resembled plague, but to ensure the diagnosis a mouse was inoculated intraperitoneally on the 24th with one drop of a broth emulsion from one of the tubes planted on the 22nd. The mouse died on the 25th. Plague bacilli abundant in all the organs, but particularly in the liver.

"On 25th the growths in the tubes planted from the edge of the abdominal ulcer showed a mixed growth of staphylococcus albus, and plague bacilli.

"The previous history of this case is as follows :—The patient was a cook on board the S.S. *Bormida* which left Hong Kong on the 5th March, calling at Penang and Singapore on the way to Bombay. Seven days before arrival in Bombay he began to suffer from fever. The duration of the ulcer in the abdomen was unknown, but from clinical evidence must have been of at least seven days' duration before it was seen by me on the 22nd. He began to suffer from delirium on the 21st, his temperature being 102·4 at 7 a.m. on that date. After landing he was first taken to the Goculdas Tejpal Hospital, and then transferred to the Modikhana. I am indebted to Dr. Turkhud, in charge of the Modi-Khana Plague Hospital, for the above information.

Wm. Glen Liston, Lt. I.M.S.,
attached Indian Plague Commission."

The man died on the 28th March, or six days after the first bacteriological examination was made. As the ship had a crew of Italian and Chinese, it was difficult to obtain any reliable information regarding the Chinaman cook. For this and other special reasons I would recommend that no conclusion be arrived at regarding plague. There was another Chinaman on the same vessel at the same time with a temperature of 102° and an old left inguinal bubo. We took him out of the vessel on her departure from Bombay, not that he was a plague case, but so that the vessel may not run the risk of quarantine at a foreign port in the event of the Chinaman being found with fever and a bubo. We know all about this man's old bubo, as the fact had been noted by us in the official papers when the vessel was leaving Bombay on a previous occasion. The man was all right next day, and has continued so.

(Witness withdrew.)

Mr. J. H. Du Boulay, I.C.S. recalled and further examined.

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25,507. (*The President.*) There are a few other points about which we require some further information from you?—Certainly.

25,508. (*Dr. Ruffer.*) Can you tell me how many Plague Hospitals there are in Bombay under the Municipality?—The Arthur Road, the Mahratta, the Modi Khana, and the General Muhammadan are those directly under the Municipality, and we have considerable control over several others—I mean we have greater control over one or two others than we have over the absolutely private hospitals.

25,509. What is the medical staff of the Modi Khana hospital?—Dr. Turkhud is in charge of it. There are six nurses, three English and three local.

25,510. How many patients are there?—Seventy-two plague patients at present.

25,511. And how many other patients?—Forty-six observation and other diseases.

25,512. Practically about 120 patients?—A hundred and eighteen, yes.

25,513. Has the doctor in charge got any other duties besides his hospital duties?—I think he has duties in connexion with the Leper Asylum.

25,514. Do you think it is possible for a man to look after 120 patients and do duty somewhere else as well?—He only spends a few hours there, but I am hardly competent to give an opinion about a medical man's ability.

25,515. Do you think it is possible?—He is obviously away for a certain number of hours a day, and he cannot be attending to patients while he is away.

25,516. How many nurses are there?—Six.

25,517. Three day and three night nurses?—Yes, I think that is how it is arranged. These arrangements are all under Colonel Wilkins, and they do not directly come to me.

25,518. How many Hospital Assistants have you got?—Two.

25,519. Would you go to the next hospital?—The Arthur Road. The Medical Officers are Dr. Choksy and Dr. Fraser.

25,520. Does Dr. Choksy practice as well as look after the hospital?—I hear of cases where he attends on plague patients.

25,521. Has he any other duties besides at the Arthur Road Hospital?—I do not know of any others. He used to be in charge of the Leper Asylum, but he has given that up.

25,522. What is the total number of patients?—One hundred and thirty-four plague cases, and one hundred and five observation and other diseases; total 239.

25,523. The ordinary staff consists of Dr. Choksy and Dr. Fraser: anybody else?—There are no other doctors. There are 13 nurses, four Hospital Assistants, two compounders, and 46 ward boys.

25,524. Are these Hospital Assistants allowed to do any work outside the hospital?—I think they practically never leave the hospital.

25,525. Will you go on to the next?—The Mahratta Hospital has got Dr. Dhargalker and Dr. Lam, and there are two people who are called House Surgeons—they are not fully qualified—Suntoodji Ramji and Eknath Hate. There is also a Vaidya who takes charge of the considerable number of patients who prefer native treatment.

25,526. How many plague patients are there?—In the Mahratta Hospital 222 plague cases, and 54 observation and other diseases.

25,527. Do you think the medical staff is sufficient for that number of cases?—I think so. There are three Hospital Assistants, and three medical students. Of course the people do not like excessive attendance, they prefer being left alone as much as possible, that is the great thing in the Mahratta Hospital.

25,528. That is a hospital where they do the bathing treatment chiefly?—Yes, they prefer the Mahratta Hospital to the Arthur Road.

25,529. What is the other hospital?—The other is the Northbrook Gardens. There is only a native hakim in charge of that. That is a Musalman hospital.

25,530. How many nurses are there?—I do not think there are any nurses there. There are three ayahs; they do not like English attendants.

25,531. In going round the hospitals, I noticed that a great number of the patients are tied up in the beds: do not you think that could be prevented if you had a larger number of nurses?—If you had a very enormously increased staff, it could be done. We should have to have a nurse for every two or three patients.

25,532. Is it not a very painful process to be tied up in bed when you have fever?—It has never been done to me. I think the patients are mostly delirious.

25,533. Do you think it is a pleasant process?—The nurses, I presume, would merely hold them instead of tying them.

25,534. I want to ask you about disinfection. You disinfect a good deal with perchloride of mercury?—Almost entirely.

25,535. What steps did you take to see that the perchloride of mercury used was of good quality?—I have had one specimen analysed within the last two or three months, and that was practically pure.

25,536. It was never analysed before two or three months ago?—I do not know what the Plague Committee did. I notice in their report that they took frequent steps to have it analysed. The perchloride of mercury here is received in packets from the manufacturer. If there is any break in the seal, the sample is rejected.

25,537. How long ago is it since the samples were analysed?—Within the last two months.

25,538. What was the result of the analysis?—The perchloride was practically pure.

25,539. What impurities did it contain?—That is all I have got from the Chemical Analyser—that it was practically pure.

25,540. Have you ascertained the strength of the solutions which are used?—Yes, I have had samples analysed from time to time.

25,541. Could you give us the result of those analyses?—One was made by Professor Wright, taken from a bucket containing 1 in 3,000.

25,542. Was it acid? The solution that you used is supposed to be acid?—Yes, the solution was slightly acid.

25,543. What is the quantity of acid that it is supposed to contain?—About 1½ to 1 of perchloride.

25,544. It should be strongly acid, should it not?—I cannot give an opinion about that.

25,545. Could you give us the result of the other analyses which you have?—I got from the Chemical Analyser an opinion on the point of acidity. He suggested the use of hydrochloric acid one lb., with one lb. of mercuric chloride to make a hundred gallons of solution. The above proportions are correct for pure water. To meet the possibility of ordinary alkaline salt when it is being used, it might be advisable to increase the hydrochloric acid to 1½ lbs. per hundred gallons of solution. That rather strengthens my belief that it is sufficient.

25,546. If it is only slightly acid, it simply shows that the amount of acid has not been added. It should be strongly acid if it contains 1½ per cent. of hydrochloric acid?—I do not know. I think the hydrochloric acid is useful for other purposes, but of course it should be there if you put it in. I went to another district and made some of the stuff myself, and took that out in the district and took a sample of that, as well as of what they were actually using; and that came to 1·206 per 1,000 as the strength of the sample I myself prepared. What they were actually using before, with the preparation of which I had not anything to do, came to ·610 per 1,000. In another case I did the same thing. I made some myself, and took a test of what they were actually using. What I made myself came to 1·478 per 1,000, and what they were actually using came to ·612 per 1,000. In another case I took a test of what they were actually using, and it came to ·7 per 1,000. In another case I took a test of what they were actually using, with some that I prepared myself, and what they were actually using came to ·99 per 1,000; and that which I prepared myself came to 1·08 per 1,000. I think it right to point out

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that that district has been without a district officer for some time. These, of course, were tests I took for my own information originally, not for yours. I also took some tests later. After I began taking these tests, and was rather unsatisfied about them, I asked one district officer to put a larger quantity of perchloride in the solution. In taking a test later I prepared a sample myself, as I wanted to see particularly what was the effect of the metal pump which they were using. I took one sample straight from the tube before the pump was put in, and another sample I pumped with a metal pump through a long greased tube in order to see what the effect of the metal was. The pump immediately became covered with silver—mercury I suppose—but the Chemical Analyser reported that both samples were 2 per 1,000.

25,547. The difference would be exceedingly small. Have you anything else?—I have told you of the perchloride I took, and I have just made a rough note of other disinfectants that were tested last year. Carbolic acid powder was tested five or six times during 1898. It was found to contain 13 per cent. of acid. Carbolic acid was tested two or three times, and each time found to be of good quality. In another case there was an analysis of perchlorde of mercury in use taken by Dr. Ruffer which gave 1·25 per 1,000 as the result.

25,548. How did you ascertain the temperature in the sterilising stoves?—By the pressure outside—by watching the gauge outside.

25,549. Do you think that is a good method? Have you ever found that the interior of the bundles of clothing that were put inside, was not up to the proper temperature?—Yes, on the occasion that I went round with you, sir, we found that, but you had to search for those places where the clothing was cold.

25,550. Part of the clothing was cold?—Yes.

25,551. But would it not be better to ascertain the temperature in a bundle of clothing each time; would it not be a more efficient method?—It would be more efficient I think. It was contrary to orders that that clothing was put in in bundles; the clothing ought to have been put in loosely, as is done now.

25,552. (*Prof. Wright.*) What method do you think is the best in your experience of getting information of plague cases while the patients are actually alive? Have you found a system of reports by doctors to be satisfactory?—No.

25,553. Have you found that the system of reporting by volunteers gives you satisfactory results; that you receive information of all the cases of plague that occur?—No, we never had received information of all the plague cases that have occurred before death, but then the cases are very often very virulent, and die in six or seven hours sometimes.

25,554. What do you think about the system of discovering plague cases by house-to-house visitation?—It is absolutely intolerable to the people; that is my experience of it.

25,555. What systems do you at present adopt—the system of getting reports from medical men, and the system of reports from volunteers?—The reports from volunteers; we also find out where every death occurs—not quite every death, but we find out all but about five per cent. of the deaths that occur in the city.

25,556. I am talking about living cases?—Those houses where deaths are occurring come under closer observation by the staff itself; they search those houses. Very often we get a great deal of information from the friends of the patients, and we send the cases to hospital; we also get a good deal of information from the neighbours who object to having plague cases near them; and we get a certain amount of information from spies, and we have all sorts of minor sources of information.

25,557. What percentage of plague cases do you think are reported to you during life? Do you receive information of one per cent. of plague cases by all these means?—It is very difficult to put it in that form straight away; I should have to work it out. I could hardly, without thinking it over and working all the figures out, give you an idea.

25,558. When you find the plague patients during life, what is your policy? Is it not the case that patients were removed to hospital by force?—I know of no occasion where force has ever been used; they have always been persuaded eventually.

25,559. Your policy is to remove them to hospital?—Yes.

25,560. Do you in any case leave a patient behind in his own house?—Occasionally.

25,561. In what cases do you leave him behind in his own house?—If he is moribund; it practically comes to that. Unless the man is certified by a medical expert to be in a very dangerous state he never is left in his house. District officers have a discretion to leave patients at home if proper arrangements for isolation and treatment can be made. It is very rarely exercised.

25,562. Supposing you find great opposition to his removal, then would you under the present system leave him in his house?—Opposition is nearly always backed by a medical certificate that the man is moribund, or in a very precarious condition.

25,563. Do you think it good policy to remove plague patients to hospital; do you think that it arouses much opposition, and leads to much hiding of cases?—I suppose it does, yes.

25,564. Do you think it would be a better system not to remove anybody to hospital, except people who were really anxious to go?—I should say not. I do not know how this infection is spread, but I imagine that the patient in the house is the centre of infection. Most of our houses are big chawls in Bombay, and you cannot isolate patients in those places.

25,565. The advantage of removing them to hospital is that you remove the source of infection, and the disadvantage is that you lead to the secretion of cases. I am asking you to judge whether you think the advantage of removing the source of infection counterbalances the disadvantages which are associated with the secretion of cases?—I do not feel that I am able to pronounce an opinion about that.

25,566. I want to know whether you have arrived at an opinion about it, whether it would be a wiser policy?—I have not arrived at an opinion about it.

25,567. What steps do you take when you leave a patient in a house to prevent him disseminating infection? Supposing you leave a moribund patient in his house, what steps do you take to prevent his becoming a source of infection?—Nothing beyond giving instructions to the people in the house, and beyond talking to them seriously if they disobey.

25,568. There is no system of periodical disinfection of floors when the patient is left behind?—That is occasionally done. The people are told to disinfect, and are given disinfectants to use, but the houses are not disinfected as a rule by our staff in those cases.

25,569. Do you think it would be practicable in these cases to go into their houses and disinfect their floors and walls and clothes periodically, or do you think it would not be practicable?—It would not be practicable. You could not disinfect the most infected part of the room very well; the patient would be lying there, and you cannot very well disinfect his bedding while he is on it.

25,570. You think it would be difficult to do it satisfactorily?—Yes, and there would be a certain amount of opposition too. It would not be so bad as removing them, of course, but they would say, "Why cannot you let us do this?" and there would be a certain amount of opposition.

25,571. Your measures that you take to prevent the spread of infection from living patients consists chiefly of removing them to hospital?—Yes.

25,572. When you remove the patient to hospital do you disinfect the room from which he has been removed?—Yes.

25,573. What steps do you take to prevent infection occurring after a death from plague has occurred?—We go at once to the room and burn all the clothing we find lying about.

25,574. How do you receive information that a patient has died of plague; do you receive the medical reports?—We get from our volunteer agents the same sources of information as we get about living patients, and in addition we have the cemetery reports.

25,575. You have reports from doctors, reports from volunteer agents, and reports from the cemetery?—Yes, and reports from our own staff, and spies, and the Municipal staff.

25,576. How many reports do you get from doctors, private practitioners, of cases of death from plague?—Not a great number, about 30 or 40 a week, or something of that sort.

25,577. That means about five a day, and your mortality may be sometimes 300 a day on the average?—Yes.

25,578. So that that is a very ineffective method?—I am speaking of private practitioners, who are not volunteers; the volunteers work harder.

25,579. Do you think that represents the number of plague cases that are actually attended by doctors?—No.

25,580. You think there is a good deal of secretiveness, and the doctors do not report cases?—I should think so.

25,581. You have your reports from volunteers, and spies, and at the graveyards; will you tell us what is the agency you employ at the graveyard?—There are Hospital Assistants there who ask the symptoms from the people who bring the body, and naturally the people are not in a hurry, as a rule, to say that it is plague, but still there are a certain number who give the information, and as soon as that information goes down to the district the house is dealt with. The Medical Officers visit every house where a death has occurred and make inquiries as to the cause.

25,582. I understand that on one particular day you had a death rate of 391: do you remember how many of those deaths on that day were discovered to be plague by means of this agency at the graveyards and burning ghauts?—I cannot tell you that.

25,583. How many were put down as plague out of that?—I think it was certainly under 200.

25,584. And your normal mortality would be about 80; is not that so?—Yes.

25,585. And probably 310 died of plague?—Yes, about that—there is a good deal of measles now.

25,586. At any rate, it would be about two-thirds of the probable deaths from plague that you find out by these means?—I was going to tell you that we do not accept the cemetery reports as final that such and such a case is plague. My medical men go round to the houses, and make inquiries from the neighbours regarding every death.

25,587. On a day like that you would have 391 deaths; how many of them would be investigated afterwards?—Every death is investigated whether it is put down as plague or not.

25,588. Is a man sent to the houses?—A medical man goes to every house where a death occurs; but of course they know a great number of them before—they are cases that passed through their own hands.

25,589. Do you mean to say that 391 visits were paid by medical men to discover the cause of death?—You would probably have to knock off over 200 to start with, of cases they knew about beforehand. There is a great deal of sickness reported to our medical men beforehand; they know all about those cases, and about all those that they have had to deal with before. They are responsible to go and find out what the cause of death was in every case where they do not already know it.

25,590. There are Hospital Assistants at the cemeteries and burning ghauts, and they write a list of cases?—The cemetery officers merely record the opinions of the people who come with the bodies there. They say, "What symptoms had he and what has he died of?" And from the answers they diagnose cases as plague or as the case may be.

25,591. They send a list then of the deaths that appear to them to have been caused by plague; who does that list go to?—The record of all the deaths is sent to the Health Department.

25,592. Are they sorted out there?—They are sorted out at the Health Department, and the Health Department send the various lists down to the Inspectors.

25,593. Who sorts out the cases of plague?—They do not sort out the cases of plague.

25,594. On the day when there were 391 deaths, a list of the cases would be sent to the Health Department, and 200 of these would be deaths that occurred from plague. What happened to that list in the Health Department?—You insist on speaking of the plague cases; the deaths are all jumbled together; they do not sort out the plague cases there.

25,595. What process takes place at the Health Department?—The clerks sort them out according to the different sections of the city to which they belong, and put down the names and addresses and the causes of death. I have a copy of each section made, which I send to the District Officer responsible for that section.

25,596. Do you send it the same day?—The same night, and he gets to work on it the following morning.

25,597. (*Dr. Ruffer.*) Twelve hours afterwards?—Yes.

25,598. (*Prof. Wright.*) In the Health Office they are sorted out according to the sections in which these deaths occur, and a list is sent to your Divisional Officers. What steps are then taken?—They check these by their registers and books.

25,599. What registers and books?—They keep registers of all sickness and deaths that they hear of in their district, and of all plague cases. If he has a plague case, and removes it to the hospital, and the case dies, the death appears in the cemetery list, and it comes back to the district office, and he looks at the book to see if he has treated that man or not. If he has, there is no further action to take, as he has already disinfected the place when he took the patient to hospital. Similarly when a death occurs, although he may not have heard of the sickness, he has very likely heard of the death before the cemetery list comes in, and he may have gone there and disinfected the place at once, if he thought it was plague. If that has happened, he ticks it off, and it is disposed of. The cemetery list would come to him 24 hours later, but every death in the city, which is not sent from a Plague Hospital, or sent with a certificate from a volunteer, is supposed to be caught by the police, who give earlier information than is received from the cemetery.

25,600. I have not understood this yet. The list goes to the Health Office, I understand, and then it goes to the Divisional Officer; the Divisional Officer looks through the list of the day, and he recognises the cases of people whom he has previously dealt with?—Or there may be a large number that may not require disinfection—who were not plague.

25,601. There are a large number he may not have heard of before, and who are on this list?—They are not a large number; I should say about ten in thirty.

25,602. About 30 per cent. of the cases were not heard of before?—Yes.

25,603. He may have received reports of two-thirds of the sickness occurring in Bombay?—Of the deaths.

25,604. This is the first notification of the deaths?—No, I have said that the police also give us information of deaths. As a funeral party goes along the street, a policeman will go up and inquire where they came from.

25,605. To whom do the police give the information?—To the Divisional Officer through the Registration Office. There are recording offices all over Bombay—seven or eight. The police instantly give information there, and the recording stations pass it on to the Divisional Officers.

25,606. You have a further record of deaths supplied by the police?—I do not call it a record; it is merely an auxiliary means of getting early information of deaths.

25,607. Does that go to the Health Office?—No.

25,608. How does that get to the Divisional Officer?—It gets to him from the recording station. There are seven or eight recording stations which receive the information from the sepoys who find the house, and this is sent on to the District Officers.

25,609. That is information of death; it does not convey any information as to the cause of death?—None whatever.

25,610. I mean in a large majority of these deaths the Divisional Officer does not know whether they are due to plague or not,—he does not know anything about the cause of death; is not that so?—Yes, there are a large number of cases when he only learns the cause of death by subsequent inquiry. I wanted to point out to you that this information from the police is prior to the information that they give us in the

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cemetery, so that when District Officers receive information from the cemetery they have already inquired into the death. They have only a few left on the fever sheets.

25,611. Does the Medical Officer visit each house in which a death has occurred?—Yes.

25,612. In the case of the 391 deaths on that day, a medical officer would have visited each house and made a report?—Yes, but of course there are a certain number of cases of death that we cannot trace, owing to wrong addresses being given.

25,613. When he has not seen a patient, he has only been able to make inquiries from the relatives. The information with regard to the cause of death is from inquiries made from relatives at the graveyard, and inquiries from relatives at the house?—Yes; but there are a number of sick people, and dying people, and dead people, either of plague or not of plague, whom the medical officers have seen before the body is removed to the cemetery.

25,614. Those who have been seen during life are a very small proportion of the total cases, are they not?—I could not give the proportion; it would require a lot of working out.

25,615. What means have you of arriving at a conclusion as to cause of death in the case of the people who die in Bombay? Will you put in all the information in answer to that question? As far as I have understood it is from inquiries by Hospital Assistants at the graveyards?—You leave out the cases the district officer knows before.

25,616. That is a small percentage?—It is a large percentage.

25,617. I want to know what means there are of determining the causes of death in Bombay?—(Witness subsequently supplied the following information):—From an examination of my weekly records for the week ending 4th March 1899, I find there were 2,307 deaths reported from the cemeteries and burning grounds. Of those 2,155 were traced in the city, 1,077 were found to be due to plague, 513 occurred in hospital, and a considerable proportion of the remainder were seen by the Sectional Medical Officers either before or after death. I am unable to give the exact proportion, because being satisfied that my officers do not put down deaths as due to plague without proper verification, and finding rather that the tendency is to accept the statements of relations that death is due to some ordinary cause, I have not exacted from them any systematic account of the grounds on which they put down a death as due to plague. Of the remaining 1,078 deaths that were traced—

287 were seen by the Sectional Medical Officers before or after deaths.
90 were certified by qualified practical practitioners.
1 was certified by a medical practitioner (unqualified).
38 were seen before death by members of the volunteer Plague Committees.
44 died in the public hospitals.
2 died in the Lunatic Asylum.
1 in Military Lines.

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giving a total of 463 where there was fairly satisfactory evidence that death was not due to plague. In the remaining 615 cases the Sectional Medical Officers visited the houses where deaths occurred, and made inquiries to the best of their ability from the friends, residents, and neighbours. In 290 cases they satisfied themselves that death was not due to plague. In the remaining 325 cases the results of their inquiries were unsatisfactory, and they were put down as suspicious.

To sum up, out of 2,307 deaths, 1,077 were undoubtedly due to plague. In 325 cases the results of their inquiries lead the Sectional Medical Officers to put the deaths down as suspicious. In regard to 463 there was fairly satisfactory evidence that they were *not* due to plague. In 290 cases the Sectional Medical Officers satisfied themselves by inquiries that death was *not* due to plague. In 152 cases it was impossible to make inquiries owing to failure to trace the houses where the deaths occurred.

The average death rate for the corresponding week in years before the outbreak of the epidemic was 543. In the week under examination, putting on one side the 1,402 cases of plague and suspicious, there were 905 deaths in regard to which no action was taken for plague. The difference (362) between 543 and 905 should, however, be reduced by 103 deaths due to an epidemic of measles, in order to arrive at the approximate number of plague deaths which altogether evaded detection. For the week under examination I estimate this number at 259.

25,618. Could you not receive more complete information than you do at present by a system of corpse inspection?—Undoubtedly.

25,619. Do you think corpse inspection would arouse much opposition?—Undoubtedly it would.

25,620. Do you think it would arouse less opposition if conducted at the graveyards, or burning ghauts, than if conducted at houses?—I think it might be conceivable, by very very slow processes, to arrive at a certain amount of compulsion that they should be examined in the houses, but it would be a very slow process, and probably take a couple of years to work up to.

25,621. If you find out that you know very little about the causes of death in the large majority of cases, then you feel inclined to think that a system of corpse inspection should be gradually introduced, you think it would be wise, and that it would be an advantage to introduce it?—Yes.

25,622. (*Mr. Hewett.*) Is a certificate required from a duly qualified qualified medical officer before anybody can be sent to the Plague Hospital?—Yes, but it is not insisted on in every case; if there is no doubt, and the people do not object.

25,623. Have you any knowledge of the number of cases sent to the Plague Hospital under certificates, who have turned out to be not suffering from plague?—I have no idea whatever.

25,624. Is it a considerable proportion?—The doctors in charge of hospitals are inclined to make rather a fuss about such cases. One or two cases have come to my knowledge, but not a large number. The tendency is rather on the other hand to send cases for observation, which are really plague, I think.

25,625. Do you find any tendency among the relatives and friends of patients to send them to hospital?—There are a certain number who go every week voluntarily. It is a very fair proportion of those who do go to hospital now.

25,626. Have you any facts to show the tendency of a second case to occur in a house where a case has already occurred?—I had some statistics collected, but I really do not think they are very valuable, but I have got them here if you wish to see them. I have not worked them out myself, but that is the belief I always had till I got these statistics, that there was a tendency for cases to recur in a house. These statistics seem to show that the number of houses where single cases occurred is rather larger than I anticipated, but whether that is due to disinfection or not, I do not know. There are the facts.

25,627. Have you found a tendency for a second case to occur in those instances in which you have left moribund patients in their houses?—No, I have not found that particularly, but all these things are questions of close observation, which we have not got the means of carrying out in Bombay—we have not got the establishment, nor the knowledge of the cases that occur.

25,628. Have you permitted people who are not moribund to be treated in their own houses here?—No, except in thoses cases that I spoke of.

25,629. Are you still taking all the contacts to contact camps?—We have not got what you would call a contact camp, I mean the restrictions are almost entirely abolished. All we can say is that, "you must "bring your cooking pots to camp, and you must live "there." They can go to their work, but they are expected to sleep there; they do not go to their own houses.

25,630. Do you think that you know little about the cause of death in the great majority of cases of death?—I do not think so. Of course we do not know much about the ordinary causes of death. We do not bother very much, as long as we are satisfied that it is not plague. We take more or less what the cemetery clerks put it down as, if there is nothing suspicious.

To reduce it to the minimum, I should say that there are 300 cases a week which we make mistakes about, that are probably due to plague, and which we have not treated as suspicious.

25,631. Your meaning, then, is that by the facts ascertained by district officers, and by reports in hospital, supplemented by the subsidiary inquiries which are sent to the Health Department, you manage to ascertain the cause of death in all but about 300 cases a week?—That is about what I worked it out last week.

25,632. (*The President.*) Do you find it now more easy to induce people to go to hospital than in former epidemics?—My experience of former epidemics was not very great. Of course there was a great deal more force displayed always in the time of the first outbreaks, and I do not think the people cared to face the possibility of a struggle with the authorities then. As a matter of fact, now, there has been no case in which, to my knowledge, a man has absolutely resisted being taken to hospital. A case did occur to me one day, but that was eventually got over. He wanted to leave the room, but the doctor stood in the way: that was all.

25,633. In regard to moribund cases, which have been left at home for treatment, have you any knowledge whether such cases have or have not been the means of communicating plague?—I have no figures that I could put before you. I do not think it is possible to form any real opinion about it in Bombay, because, as I say, our men are all working hard, and they have not time to carefully study each case, and, also, there are a certain number of cases which escape observation; so that any observation would be very incomplete; but so far as I have heard from the district officers here, I have not heard it stated that moribund cases left at home have had a tendency to spread plague. Cases occur afterwards, but then they have in many houses two or more cases, so that that again would not attract much attention; they could not say that it was because any case was left in the house that it caused the spread of plague. A district officer having a badly infected locality told me that he thought it was entirely due to one or two cases being left in the street; but there, again, it is an unsound inference, it seems to me; there were a number of cases, and two cases had happened to be left there.

25,634. You have not followed up the question sufficiently in order to answer it definitely?—No, it is a very large question indeed.

25,635. I understand, therefore, that you do treat certain cases in their own houses?—We leave moribund cases at home.

25,636. Only the moribund?—I think I explained that—that there were a certain percentage of cases, mostly rich people and influential people, who obtain certificates to the effect that the patient is in an exceedingly precarious condition, and that the removal will cause a great risk of death; and if the opposition is very great, we give it up. One does not like to enforce the removal, and to face that risk.

25,637. (*Prof. Wright.*) You said in answer to Mr. Hewett that you knew the cause of death in all but 300 cases a week?—Yes, I worked it out last week.

25,638. You mean that there were 300 cases of plague which you do not recognise as plague?—That is the conclusion I came to. There are a certain number of cases that are treated as suspicious. There is no record, but they disinfected in those cases. These suspicious cases are excluded from the 300.

25,639. When you recognise a case as plague you disinfect the house, do you not?—Not the whole house.

25,640. How much, when it is a chawl?—The room itself, and generally the two adjoining rooms.

25,641. How many houses would be disinfected in a day when, for instance, the mortality is 391? That would involve a disinfection of over 300 houses?—Probably.

25,642. Have you the means for disinfecting 300 houses in a day? How many gangs have you got?—I cannot tell you how many gangs, but there are about six or seven men in a gang, and there are about 600 men actually employed.

25,643. That would be 100 gangs?—About 100 gangs.

25,644. Have you got plant for 100 gangs?—The plant is not very much.

25,645. I mean, such as it is; you would want a bucket and a pump, and you would also want an Inspector?—We have not got an Inspector to every gang. We have got a muccadum, who is the head coolie. The Inspector goes round to three or four or five gangs. *Mr. J. H. Du Boulay, I.C.S.* 17 Mar. 1899.

25,646. Is the muccadum a responsible man that you can trust?—He is merely a head coolie; he is held responsible by the Inspector.

25,647. All I want to arrive at is this: when you have 300 houses to disinfect in a day, have you got the men and the staff to do it in a way that you would consider satisfactory?—Yes, it is done.

25,648. Are you satisfied whether it is done properly?—It is a question for you to decide whether it is satisfactory.

25,649. I want to know whether you are satisfied with it?—I am satisfied with it to this extent, that if you want to make it perfect you must go bankrupt at once.

25,650. Are we to write down in our minds that it is an effective or ineffective method of disinfection, or is it possible that a large number of the disinfections are not properly done?—I do not think it is really satisfactory. Every house ought to be disinfected by a doctor, I understand.

25,651. With the staff and the plant that you have got, how many houses do you think you could manage to do in a day in a way that would enable you satisfactorily to make this a basis for a further inference as to the way in which plague spreads?—I have never attempted to draw a plan of that. If the district officers tell me that they find it difficult, they are at once given more coolies and supervising staff. I have never attempted to form any estimate of the exact number of coolies required for so many cases. If they find their men are overworked, the work is done in the same way, only it means that the men go on working longer hours, and they go to houses a longer time after the infection has occurred.

25,652. You do not think you can infer, with a death-rate of 391 in a day, that 300 houses are cleared from infection by your disinfecting operations on that day?—I think, from the analysis of my disinfections, it occasionally does occur that the work is not properly done.

25,653. (*Dr. Ruffer.*) What do you mean by occasionally; that is rather an elastic term? Do you mean 10 a day, or 20 a day? "Occasionally," in my mind, means 1 in 100. I want to know what it means to you?—I should say 3 or 4 in 100 is my idea of it, but it is impossible for anyone to say.

25,654. I want to know about the cemeteries. Is it true that the Assistant Surgeon at the cemetery is on no account to examine bodies there?—He has orders not to.

25,655. Under any conditions?—Yes.

25,656. I went to a cemetery the other day, and a child was brought in, and the relatives said it had suffered from asthma. I believe the child's certificate in the registration in the cemetery afterwards was entered as "General Debility"?—Was not it the other way round?

25,657. It would come to the same thing. It was given to me as asthma?—I saw the certificate of the Plague Authority, that it was "General Debility," which I believe came in afterwards, that is to say, after the cemetery clerk had made his diagnosis.

25,658. The relatives told me the child had asthma. How did the Plague Authority come to the conclusion that it was general debility?—I did not ask him in that particular case, but he had probably seen the child suffering for months previously.

25,659. He had not seen the child at all. The friends told me that it had not been seen by a medical man at all?—This is a Plague Authority, who is not necessarily a medical man.

25,660. The Plague Authority wrote it down, and it was entered in the register as general debility, but the friends said it suffered from asthma. I want to know how the plague officer arrived at that conclusion?—It depends in each case; generally it is that he has seen the case suffering. You say the friends of the child told you that he had not?

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'25,661. That is my impression, but we will ask Dr. Weir?—You cannot trust what the people say. You and Dr. Weir were there, and they were probably frightened, and perhaps thought that you were going to do something; so they might have given you a different story from what was on the certificate. I have to add, in regard to the question of compulsory removal to hospital, that we do not attempt to deal with the Health Department sweepers. They are difficult to manage, and the disastrous possibilities of a strike among them compel us to leave them alone as a matter of policy. They are isolated, so far as possible, in their own chawls, and dealt with entirely by the Health Department itself.

(Witness withdrew.)

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Lieut.-Col. T. S. WEIR, I.M.S., recalled and further examined.

25,662. (*The President.*) When you were before us previously we asked you for certain statistics with which you are now in a position to supply us?—Yes.

25,663. You were asked about a case of plague which was communicated by a rat-bite and about cases of importation by sea?—I have not been able to get the information as yet.

25,664. Then there was a question raised as to the period of incubation?—That information is not ready yet. I have sent circulars round to all our medical men.

25,665. You were asked if you could supply us with the number of cases of plague in each ward or district in Bombay since the origin of plague?—I have a return showing the mortality since 1896, as follows:—

STATEMENT showing the NUMBER of DEATHS from BUBONIC PLAGUE from 1st September 1896 to 16th March 1899.

Wards, &c.	Sections.	From 1st Sept. to 31st Jan. 1896.	1897.	1898.	From 1st Jan. 1899 up to 16th Mar.
A.	Upper Kolaba	1	50	31	5
	Middle and Lower Kolaba.	77	189	311	186
	Fort, Southern	2	7	6	2
	Fort, Northern	46	216	923	229
	Esplanade	1	33	91	52
B.	Mandvi	308	334	911	251
	Chuckla	58	81	464	95
	Umarkhadi	84	259	746	208
	Dongri	95	267	716	304
C.	Market	87	182	1,044	328
	Dhobi Talao	110	367	1,034	307
	Fanaswadi	32	126	548	270
	Bhuleshwar	68	151	724	259
	Khara Talao	51	118	348	144
	Khumbharwada	83	391	974	330
D.	Khetwadi	43	272	655	270
	Girgaum	42	258	850	419
	Chowpati	7	52	174	106
	Walkeshwar	5	125	101	37
	Mahalakshmi	7	219	192	101
E.	Mazagaon	93	553	782	348
	Tarwadi	20	207	343	251
	2nd Nagpada	29	196	303	100
	Kamathipura	227	619	1,005	339
	Tardeo	31	363	524	316
	Byculla	88	919	1,432	676
	1st Nagpada	27	165	244	137
F.	Parel	23	603	759	318
	Sewri	13	122	59	108
	Sion	5	460	188	113
G.	Mahim	12	666	383	272
	Worli	41	460	382	158
	Water Division	2	8	10	3
	Non-Resident and unknown.	113	1,965	978	42
	Total	1,936	11,003	18,185	7,984

25,666. You were asked if you could supply us with the number of houses marked unfit for human habitation?—I have that return from the Engineer, and I put it in, as follows:—

STATEMENT showing the Numbers of Houses marked "UHH" in each Ward and in each Section in Bombay in 1897 and 1898.

Ward.	District.	No. of Houses marked "UHH."
A.	Kolaba	47
	Fort	20
	Esplanade	11
B.	Mandvi	27
	Chuckla	35
	Umarkhadi	38
	Dougri	16
C.	Market	5
	Dhobi Talao	84
	Fanaswadi	2
	Bhuleshwar	15
	Khara Talao	12
	Kumbharwada	70
D.	Khetwadi	7
	Girgaum	4
	Chowpati	2
	Walkeshwar	7
	Mahalakshmi	1
E.	Mazagaon	28
	Tarwadi	17
	2nd Nagpada	14
	Kamatipura	464
	Tardeo	8
	Byculla	36
	1st Nagpada	1
F.	Parel	5
		665

25,667. Can you give us tables showing the density of population in each ward?—Yes, the following statement shows what is required:—

STATEMENT showing POPULATION, and the DENSITY by SECTIONS and the AREA of each SECTION.

Wards.	Sections.	Population.	Area in Square Yards.	Mean Area in Yards to a Person.	Square Acre.	Persons to an Acre.
A.	Upper Kolaba	4,335	1,220,267	281·49	252·12	17·19
	Middle and Lower Kolaba.	38,622	723,733	58·13	149·53	91·09
	Fort, Southern	5,951	670,400	109·67	138·51	38·52
	Fort, Northern	32,847	562,667	17·13	116·25	282·55
	Esplanade	10,064	3,515,200	329·39	684·95	14·69
B.	Mandvi	37,205	963,644	25·83	199·10	187·31
	Chuckla	32,107	248,000	7·70	51·23	626·47
	Umarkhadi	52,466	504,000	9·60	104·13	503·85
	Dougri	36,317	1,324,600	43·59	273·05	111·03
C.	Market	44,751	404,800	9·04	83·63	535·10
	Dhobi Talao	39,945	505,600	12·65	104·46	382·39
	Fanaswadi	24,069	544,000	22·60	112·39	214·25
	Bhuleshwar	38,393	347,200	9·05	71·73	534·82
	Khara Talao	27,035	195,200	7·22	40·33	670·31
	Kumbharwada	52,209	252,800	7·84	52·23	616·67

Wards.	Sections.	Population.	Area in Square Yards.	Mean Area in Yards to a Person.	Square Acre.	Persons to an Acre.
D.	Khetwadi -	28,814	1,870,400	64·91	386·41	74·56
	Girgaum -	26,999	563,600	21·06	117·35	23·07
	Chowpati -	11,512	532,800	46·28	110·08	104·57
	Walkeshwar -	12,990	2,873,600	221·21	593·71	21·87
	Mahalakshmi -	17,014	3,252,800	191·18	672·06	25·31
E.	Mazagaon - -	33,640	2,907,200	86·42	600·66	56·00
	Tarwadi - -	21,208	2,481,600	116·51	512·72	41·36
	2nd Nagpada -	18,768	203,200	10·82	41·98	447·07
	Kamatipura -	29,263	340,800	11·67	70·41	414·75
	Tardeo - -	18,980	795,200	41·89	164·29	115·52
	Byculla - - -	47,463	2,843,200	59·97	587·43	80·69
	1st Nagpada -	11,133	160,000	14·37	33·05	336·85
F.	Parel - -	28,740	2,907,200	101·15	600·66	47·84
	Sewri - -	6,063	2,436,800	401·91	503·47	12·04
	Sion - -	19,601	16,316,311	832·42	3371·13	5·81
G.	Mahim - -	18,505	7,708,800	416·57	1592·72	11·61
	Worli - -	25,493	11,360,400	446·80	2353·38	10·83

25,668. How far do you think the figures in that table are correct?—The table must be interpreted with a number of reservations. For instance, there is the section of Dongri. Dongri is the section immediately to the north of Mandvi and includes Dongri Hill, which is inhabited on one side, and the quarry-holes on the east and also open land. Then there is the migration of population backwards and forwards.

25,669. You mean that a large portion of this section has no houses?—Yes; so that really the populated portion of Dongri is much more thickly populated than would appear by the table. It is the same with regard to Fort North and Fort South. The area for each person is less than would appear from the table. Then, of coure, there is a great migration of population backwards and forwards from Bombay. They go from Bombay to the country for work, and during plague years there is a great migration of population from the town proper into the suburbs, and also migration from the suburbs into the town proper.

25,670. At what period of the year were these figures collected?—They are taken from the census, from an enumeration which was made in February.

25,671. What was the migration then?—Very large numbers of people came into Bombay for work.

25,672. And they remained there from February till when?—Till the beginning of the monsoon, in June.

25,673. Therefore the numbers would only apply to half of the year?—Practically. That is one of the conditions which you have to remember in interpreting these figures.

25,674. (*Dr. Ruffer.*) With regard to the mortality as compared to the area you stated, I think, that it was smaller in certain wards?—The density of population in Bombay varies from seven square yards to each person, to over 800 square yards in the extreme suburbs.

25,675. Was the plague worse in the more densely populated quarters?—No. It is a most extraordinary fact that the mortality in the buildings in the most densely populated portions of the town has absolutely been less than in small villages in the suburbs, according to our statistics.

25,676. Are their houses as much overcrowded in the small villages as in the town?—No; they are not so overcrowded.

25,677. How do you know that?—From the census figures which show a decreasing population from the city outwards, in dwellings; 37 per cent. of the population live over 3½ per cent. of the surface area. You have, in proportion to your house area, a larger number of rooms than you have in the suburbs. In the next place you have people living in the town whose necessities compel them to overcrowd each other more. And you have a population in house-passages and in the streets.

25,678. But that is only an impression?—No; that is undoubtedly so. There are no houses in the suburbs so overcrowded as in the city.

25,679. Have you a census of the villages showing that as compared to their area they are more overcrowded than the smaller part of the town?—We have statistics which could, of course, be found, showing the number of persons per houses in villages in which cholera or plague has occurred.

25,680. Then, according to your evidence, overcrowding is not the chief factor in producing plague?—No, that is not my point; I believe it is a very important factor. But there is this fact in our statistics that the plague mortality was highest in the suburbs.

25,681. Do you think that is accurate enough to base a conclusion upon?—The statistics are absolutely correct; there is no doubt whatever as to that, and there are explanations.

25,682. What is your explanation?—Let us take, for instance, the mortality in the House of Correction. The mortality there according to the population was really higher than occurred in some of the most crowded chawls of Bombay. It is very difficult to give an explanation of that, but there is the fact. The only explanation I can give is that it is a place for prisoners, and in order to keep prisoners you must build a wall, and the wall round the prison and the walls inside it may possibly obstruct the perflation of air and give less perflation of air than exists in the most crowded chawls of the town. That is the only explanation I can give, and it is not a very satisfactory one.

25,683. (*The President.*) How long does a prisoner remain in the House of Correction?—It is a short term prison.

25,684. Where do they usually come from?—From Bombay itself.

25,685. From the better or worse localities?—From the worse localities.

25,686. Therefore there is a constant stream passing through the House of Correction of persons from the worst localities?—Yes.

25,687. Are not these prisoners likely to have come in contact with plague?—One would think so, but we have the fact that, except for the small outbreak that occurred in the House of Correction, the place has suffered very little from plague. What occurs to me is this, that if the continual stream of people from the poorer classes into the House of Correction was the cause of the outbreak in 1897, it would be a constant cause in operation since.

25,688. You mean that there was a local outbreak, and not that the House of Correction was a place where plague had been especially prevalent?—That is so.

25,689. (*Dr. Ruffer.*) Has there been any plague in the Jail since 1897?—I am not quite sure till I inquire: there have been, I think, three cases in 1898 and none in 1899.

25,690. (*The President.*) What kind of houses are these suburban houses where plague has been prevalent?—They are the old-fashioned houses which have a number of inner rooms, not communicating directly with the external air, and very ill-ventilated.

25,691. In which of these rooms do the people live and sleep generally?—In the inner rooms.

25,692. Where there is very bad ventilation and darkness?—Yes, and the ground is damp.

25,693. Further than that, is it at all probable that when plague is bad in the town there might be an exodus to those suburban houses in any large extent?—Yes, there is an exodus to them, but against that there is also an exodus from the suburbs into the town. You have at one period a migration into the suburbs and, at another, a migration from the suburbs.

25,694. During plague?—Yes.

25,695. When do they come from the suburbs into the town?—When the disease becomes prevalent in the suburbs.

25,696. And already it has become prevalent?—Yes.

25,697. Before the time it became prevalent there might have been an exodus from the city to the suburbs?—Yes.

25,698. And, therefore, a condition of special overcrowding at the time when in the suburbs plague was most prevalent?—Overcrowding in this way, that you

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have a certain increase of the house population and also a larger number of people living on the open ground in camps.

25,699. But, above all, although these are suburban dwellings, they are not free from the defects which are commonly found in the centre of a city with regard to lighting and ventilation of the inhabited parts of the houses?—That is so.

25,700. (*Mr. Hewett.*) Have certain portions of the streets in Bombay in recent years been rebuilt?—Yes, they have been widened.

25,701. Has any alteration been made in the houses in those streets?—A good many alterations have been made in the houses.

25,702. In the particular streets to which I am referring?—Yes, to improve light and ventilation.

25,703. Can you specify a particular street in which it has been done?—Yes, Girgaum Road.

25,704. Any other?—Yes. Abd-ul-Rahman Street.

25,705. Has anything been done in Arthur Road?—No; that is part of a new street.

25,706. It has not been widened, but it is a comparatively new street?—Yes. The portion between Chinch Pooghly Station and Parel Road has been built upon within the last ten years.

25,707. And Cotton Road?—Cotton Road is one of the new streets.

25,708. In these particular places are the lighting and ventilation and the perflation of air through the houses better than in other parts of Bombay?—Undoubtedly. Take, for instance, a new road, a road constructed in 1885, Ripon Road, and also Morland Road, immediately east of the Byculla Club. They are new streets with new houses.

25,709. Is the lighting and ventilation better there?—Undoubtedly, very much better. There are a number of chawls in these streets very fairly ventilated indeed.

25,710. Have you any statistics to show the ratio of attacks from plague and deaths from plague in these new streets, compared to the ratio of attacks and deaths in the other portions of the town?—We have the statistics, but we could not give the ratio.

25,711. Do you know the population of these particular streets?—Not exactly.

25,712. Not approximately?—With the continual changing of the population of Bombay and the construction of new buildings, it is extremely difficult to get it even approximately, and it is most uncertain. What we can do is to give the actual number of cases and attacks and the population of the last census. To do more it would be absolutely necessary to take a census.

25,713. Was plague bad or not in these particular streets to which you have just referred?—Plague undoubtedly was bad in one street, and in chawls off or close behind another—Morland Road. I am convinced that it would have been very much worse if the streets and houses had not been as well-ventilated as they are.

25,714. Was plague worse in Morland Road than it was in the badly overcrowded portions of the town?—No; I would not say it was worse, but it was very bad. The chawls were as much affected as in the most densely populated portions of the city.

25,715. I want to know whether the attacks and mortality from plague in Morland Road were as bad or worse than in the worst portions of Bombay?—I can only answer in a very general way. The figures are here. I think they were just as bad, although Morland Road has hundreds of yards of open ground on one side.

25,716. What is the average area per person in the suburbs?—It varies. You have from an average of 832·42 square yards for each person in Sion to 7·22 square yards to each inhabitant in Khara-Talao section.

25,717. You say that during the course of a plague epidemic there is an exodus from Bombay to the suburbs, and also at times a corresponding exodus from the suburbs to Bombay?—Yes, a migration backwards and forwards.

25,718. Does the population of the suburbs become as congested or more congested than the population of the town at any period in the epidemic?—Never; it never becomes so congested.

25,719. Can you give us the total mortality per month from the 23rd September 1896 to the end of February 1899?—Yes, it is as follows:—

TOTAL MORTALITY during the following YEARS.

1896.				1897.											
September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
925	2,994	3,024	6,244	7,627	6,928	5,419	3,620	2,433	2,326	3,112	4,076	3,616	3,389	2,984	3,736

(*continued*).

1898.												1899.		
January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March 1st to 16th.
6,802	8,283	9,303	5,185	3,021	2,106	2,435	3,264	3,618	3,664	2,646	3,311	5,796	7,576	5,426

25,720. Will you give us the normal mortality for the same period?—I will prepare that table. (The following figures were subsequently supplied by the witness):—

STATEMENT showing MONTHLY AVERAGE MORTALITY for 5 years from 1891 to 1895.

January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
2,150	2,132	2,322	2,480	2,480	2,078	2,246	2,423	2,188	2,099	1,938	2,093

25,721. Will you give us the total recorded plague mortality for that period?—Yes, it is as follows:—

STATEMENT showing the NUMBER of PLAGUE DEATHS in the following years.

1896.				1897.											
September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
79	313	273	1,271	1,857	3,083	2,266	1,316	328	99	42	70	168	178	255	644

(*continued*).

1898.												1899.		
January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March 1st to 16th.
2,934	4,498	4,973	2,171	524	150	263	543	731	728	217	470	1,591	3,040	2,452

25,722. What is the average normal mortality?—Our average mortality is about 28 per thousand.

25,723. Can you tell us to what extent the Health Department has been added to recently?—Yes; I have prepared a table showing that. It is as follows:—

RETURN of STAFF employed in the HEALTH DEPARTMENT up to the end of SEPTEMBER 1896, and that employed up to the end of FEBRUARY 1899.

	Health Divisional Officers.	Deputy Health Officers.	Inspectors.	European Sub-Inspectors.	Native Sub-Inspectors.	Ward Clerks.	Mucaddums.	Patels.	Cart Drivers.	Bigaries Men and Women.	Halalkhores. Sub-Inspectors.	Cart Drivers.	Trip-Markers.	Mucaddums.	Halalkhores Men and Women.	Gully Flushing Establishment. Engine Drivers.	Firemen.	Sub-Inspectors.	Mucaddums.	Bigaries Men and Women.	Special Medical Officer on Plague Duty.	Hospital Assistants.	Rat Killers.	Hospital Bearers.
Permanent establishment up to 30th September 1896.	—	—	7	7	44	7	57	22	639	1,950	2	127	—	47	1,646	—	—	—	—	—	—	—	—	—
Permanent establishment up to 28th February 1899.	4	7	8*	5	36	7	44	29	640	1,908	2	139	—	55	1,865	7	7	6	7	154	—	—	—	—
Extra establishment on account of plague up to 28th February 1899.	—	—	—	18	53	8	68	—	—	555	—	—	13	49	132	—	—	—	—	—	31	5	8	6

* One acts as Inspector.

The Tardeo Flats, Night Branch, and Veterinary Establishments are not shown in this statement.

25,724. In ordinary circumstances have you any Assistant Health Officers here in Bombay?—Previously to 1896 I had no medical Assistant Health Officers.

25,725. Under ordinary circumstances the Health Officer would have to do the whole work himself?—Yes, except during epidemics, when a medical staff was engaged.

25,726. Can he do the work at ordinary times, and so protect the town against epidemics?—I do not think he can now without a large medical staff.

25,727. Your establishment has been considerably increased?—Very much increased.

25,728. How many Medical Officers have you under you in the Health Department?—Eleven for Health Department duties.

25,729. Is that more than you want?—No. The total number of Medical Officers absolutely now employed on plague duty and Health Department duty is 42.

25,730. How many of those 42 are Europeans?—Five. There are a number of Eurasians. There are seven medical men who are Eurasians, and they are all qualified.

25,731. Can you give the total number of persons who have been sent to public and private hospitals since the beginning of the epidemic, supposed to be suffering from plague?—Yes, as follows:—

STATEMENT showing the NUMBER of PLAGUE PATIENTS admitted into all PLAGUE HOSPITALS, PUBLIC and PRIVATE, from March 1897 to March 1899.

	No. of Plague Patients.
From March to June 1897:—	
Public hospitals	1,531
Private hospitals	1,244
From July 1897 to April 1898:—	
Public hospitals	3,957
Private hospitals	4,157
From October 1898 to March 1899:—	
Public and private	5,818
	16,707
	184
	16,891

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25,732. Can you give us any figures for any particular hospital or hospitals to show what proportion of the persons supposed to be suffering from plague when they were sent to hospital were afterwards found not to be suffering from plague?—Yes. About 66 of the patients admitted in the Mahratta Hospital turned out last year to be cases of simple or relapsing fever. About 56 of the patients turned out to be suffering from diarrhœa, relapsing fever, or some other cause, from January 1899 up to 14th March 1899. About 10 per cent. of the patients sent to the Arthur Road Hospital do not suffer from plague but from some other diseases. From the 1st of August 1898 to the 15th of March 1899, 2,021 of the patients admitted in the Modikhana Hospital were not suffering from plague.

25,733. Were those people who were subsequently found not to be suffering from plague sent to the Arthur Road Hospital, by Medical Officers or by other people?—That I could not say, they may or they may not have been.

25,734. Can you give us any information as to the proportion of persons sent (1) to public hospitals, and (2) to private hospitals, who died within 24 hours of admission?—Yes. At Arthur Road Hospital about 38 per cent. died within 24 hours of admission.

25,735. You are probably familiar with Section 449 of the Bombay Act of 1888 regarding the registration of deaths, which places an obligation on certain persons to report death at or about the time the corpse of the person is disposed of?—Yes.

25,736. Have any subsidiary rules been issued on this matter?—No.

25,737. Do people habitually report deaths, and their cause?—At the cemeteries.

25,738. That is how that Section is interpreted?—Yes.

25,739. The report you get is the report from the cemetery?—Yes; there may be a certificate from a medical man.

25,740. For the purposes of this rule, if it is reported at the cemetery, that is taken to be a compliance with the law?—Yes. I have in my last Annual Report on the Health of Bombay, 1897, discussed the measures that should be taken for the improvement of the system of registration of deaths. I have described the steps to be taken towards correct registration. The importance of improvement is very great. The law must be altered, medical men must be registered, and medical relief given to the poor, who must be treated while living or examined after death, the latter a very serious alternative in this city not lightly to be recommended. The same object can be secured in a different way by treating every death as a death due to an infectious disorder and disinfecting the bedding.

25,741. (*Mr. Cumine.*) With regard to the drainage of Bombay, in what parts of the city do drains exist?—Roughly speaking up to Clark Road, a line from east to west through Clark Road. More than a quarter of the island is without drains.

25,742. On which side are there drains?—On the south side of Clark Road

25,743. Are the houses connected with those drains?—The houses are all connected, but only a certain proportion of the houses have house-connections on the new system.

25,744. Are the connections in working order?—Yes.

25,745. Did not Mr. Baldwin Latham, the famous expert, come to Bombay to advise the Municipality on drainage?—Yes.

25,746. Did they accept his advice?—The advice was accepted, but his proposals have not all been carried out yet.

25,747. On what system did he advise Bombay should be drained?—He practically approved of the present system except with regard to the outfall: he suggested another outfall

25,748. Is Kolaba drained, and the Fort?—Yes.

25,749. Chowpati?—Yes.

25,750. Malabar Hill?—No, Malabar Hill has open storm water drains.

25,751. Is the drainage of the rest of the town proceeding at present?—Yes; a great deal of work has been done since 1896.

25,752. Has it all been done on the same system, or has the Shone system been introduced anywhere?—It is being introduced into certain districts in which the levels will not permit of gravitation into the general system.

25,753. Now, with regard to rain-water?—That is separated from the sewage. The removal of rain-water is arranged for in a separate system of drains.

25,754. Have the houses got closets?—There are only a few hundred closets in Bombay. In the drained districts the solid matter is received in baskets or in pans at the bottom of the privies, and removed by Halalkhores, and the fluid portion flows into the drainage system. The Halalkhores remove the solid matter in baskets to depôts. There are a number of depôts which are the points on which the Halalkhores work. Each depôt is an unit of organisation. All the depôts in the drained districts are connected with the drainage system. The night-soil in the baskets is emptied into hoppers in the depôts and discharged through the sewage system.

25,755. And eventually the sewage goes to the sea?—Yes.

25,756. How does it reach the sea? Is it pumped up? Yes.

25,757. (*The President.*) Do you mean the solids as well as the liquids?—Yes.

25,758. The whole?—Yes. The difference in the drained districts is simply this, that the night-soil, instead of flowing direct from the water-closet to the sewer, is carried in baskets from the privy to the depôt, and discharged into the sewers.

25,759. I suppose in these closets there is a tube connected with the drain for liquid matters?—Yes. A connection.

25,760. There is a percolation from the baskets?—Yes; the bottom of the basket is porous. In the houses which have been connected on the new system the liquids flow into a pipe, and the pipes are connected with the street sewers. The districts where house connections on the new system have not been carried out, the liquid matter flows from an open gati into the street sewers. In districts which have not drains the solid matter is removed to depôts, and the liquid matter is received in cesspools.

25,761. (*Mr. Cumine.*) What is the old system and what is the new system?—The old system is a system of open galis or drains; the new system is a system of pipe connections, with intermediate portions of properly constructed open drains.

25,762. Is the new system being introduced universally now in supersession of the old system?—Yes.

25,763. What is to prevent the solid matter from going into the drains direct?—The receptacles.

25,764. To the north of Clark Road I understand there are no drains?—Practically no drains.

25,765. What is the system there of removing the night soil?—The same as in the town. It is removed to the depôts, and from there it is carried back to the nearest district where there is a sewer, and emptied in the sewer.

25,766. And the liquid matter?—That is received in cesspools, and a small portion of the cesspool matter is also removed to the depôts and discharged into the sewer. The remainder either soaks into the ground, or is spread over the ground, or is used for irrigating the ground.

25,767. Have you noticed that the existence or the non-existence of drains has any marked effect upon the health of the people?—I have no doubt whatever that the existence of the drains has a most favourable effect. Considering the density of our population and the miserable economic conditions under which they live, I think the relative low mortality is due in a great measure to the drainage that we have. The mortality from plague has been made lower in Bombay and Madras than in other cities in India.

25,768. How is the drainage system better for the health of the people than the system of removing by hand which prevails to the north of Clark Road?—The system which prevails to the north of Clark Road is only possible in very sparsely populated districts. For that system you have ground for a cesspool, and you must also have ground on to which a portion of the matter can flow.

25,769. If the drainage system has a good effect upon the health of the people, I presume the people who live

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on the north of Clark Road have not such good health as the people who live on the south of it?—That is not so always in all districts, except since plague came.

25,770. On what do you base your opinion that the drains are good for the people?—On statistics, and because the filth is removed from the neighbourhood of the dwellings. Where there is no system of drainage the filth accumulates and percolates into the ground.

25,771. That is a theoretical reason?—Absolutely so. I have no doubt as to its truth.

25,772. Is it within your knowledge that the health of the people in any portion of Bombay south of Clark Road has improved since the drainage system has been introduced?—Yes. In certain districts the health has improved undoubtedly.

25,773. Which are they?—The Market, for instance, and the Fort, Khetendi, and others. The districts that have been drained have shown a progressive improvement in health.

25,774. Why are solids in the drained portion of Bombay removed by hand in this way? Why are they not allowed to pass straight into the sewer?—On account of the difficulty of getting the people to use water closets, and the danger of having water closets.

25,775. What is the danger?—The danger is that they would be improperly used and become obstructed.

25,776. (*Prof. Wright.*) Are the present pipes obstructed?—Obstructions do occur, but they are infrequent.

25,777. (*Mr. Cumine.*) Is the basket movable?—Yes.

25,778. Is it found that the people remove baskets and introduce something into the pipe which obstructs it?—Into the basket, or it may be over the basket, pieces of cloth are thrown, also stones, pieces of stick, and pieces of earth. A certain proportion of the population use balls of earth after ablution. The women throw down the privy the cloths which they use in a certain portion of their life, and if those cloths happen to fall into the gali trap or pipe they may cause an obstruction.

25,779. (*Prof. Wright.*) Can you give us the comparative number of attacks in segregation camps as compared to those among the rest of the population?—I have sent that in.

25,780. You have not given us the number of people in the segregation camps, and therefore we are not able to work out the percentage of attacks?—I am afraid it would be rather difficult to get the number; there is no record for some of the camps in 1898.

25,781. Will you see whether you are able to obtain that information?—Yes. For some it can be given and in some it cannot. (Witness supplied certain figures, but they were incomplete, and he was unable to supply such figures as were required.)

25,782. (*The President.*) I suppose your drainage system in Bombay is not yet completed?—That is so.

25,783. Therefore you are not in a position to accurately estimate the advantage which you will derive from a complete system?—We are not yet able to fully estimate the advantages of the system.

25,784. With regard to Morland Road, are there any special conditions and circumstances in the houses there which are favourable to the prevalence of plague?—Yes; there are a very large number of poor people and outcasts living in very crowded rooms, and rooms which they crowd with screens and purdas.

25,785. Were the conditions in Morland Bay exactly the same as in the most crowded buildings in the town?—Yes; they are exactly the same inside the rooms only, but not outside.

(Witness withdrew.)

Lieut. H. V. Firth, I.S.C., called and examined.

Lieut. H. V. Firth, I.S.C.

25,786. (*Mr. Cumine.*) Your first experience of plague measures was, I think, as officer in charge of the railway detention camp at Bhusawal, in the early part of last year?—Yes.

25,787. In what month did you come to Bombay?—In June.

25,788. What ward were you placed in charge of?—E Ward East.

25,789. What parts of the town did that comprise?—Mazagaon, Tarwadi, and Byculla.

25,790. With regard to disinfectants, have you any reason to disbelieve in the efficacy of a single application of perchloride of mercury?—Yes; I did not see it was of much use. You empty the chawls, disinfect once, and put the people back again after a fortnight or a month, or any length of time, and as soon as you put them back again they get plague just as badly.

25,791. Therefore, what did you do?—I disinfected the room in which a plague case had occurred every day for a week with perchloride.

25,792. Having done this, did you find that the people on re-admission again got plague?—Not in the rooms that had been disinfected for a week, but in the other rooms. I believe in disinfection once if you get it in the early stages. For instance, if you find dead rats, and disinfect at once, that will stop plague; but if plague once gets a hold on a chawl, once disinfection is no good at all.

25,793. When you came to your ward in June 1898, was it badly infected?—No, there were only cases here and there.

25,794. As it gradually became infected to what did you attribute the infection?—At first, people with plague came from other wards, nine-tenths of the cases. When the plague staff got energetic in other wards they came into my section. Also, I think rats spread the disease. I do not know whether the rats got it in the houses or brought it in, but when we were taking the tiles off, we found rats everywhere, all over Mazagaon and Byculla.

25,795. Did the death of the rats appear to precede plague in human beings?—Yes.

25,796. With regard to the removal of patients to hospital, I think that soon after your arrival in Bombay you allowed at first a small number, and latterly a considerable number, of patients to remain in their rooms?—Yes.

25,797. Did you always leave them in their rooms?—No; sometimes we left them in their rooms and sometimes we put them in huts in the compound.

25,798. When you left the patients in the rooms, what did you aim at specially in order to prevent the contacts from getting plague from them?—We used to mop the floors and walls with a strong solution of perchloride, and then we used lime on the floors to keep them dry. We used to take the patient into the passage while we did this. We did not use the perchloride every day, but we used lime every day, and we gave the patients pans for spitting into and for droppings.

25,799. Did you allow the patients to sleep upon the floor?—No; we gave them a cot and blankets, or whatever they wanted. We used to burn all the infected clothes first of all, and then give them saris or dhotis and whatever was necessary.

25,800. Did you leave the family of the patient?—Yes.

25,801. In cases where the patient died, what did you do after the death?—We disinfected the rooms and sent the contacts to a contact camp. If the patient did not die, we left the contacts there and disinfected the room, and allowed them to go on living there as if nothing had happened.

25,802. In, approximately, how many cases did you leave the patient in the room or in a hut in the compound?—I have a record of about 50, but I think it must be over 60.

25,803. So far as you can see, did the contacts catch the plague?—Not so far as I could see. If you did not disinfect the room the contacts would get plague, not from each other, but from the poison in the room.

25,804. Where you did disinfect the room?—Not a single contact took plague.

25,805. After a time had you to give up this system of leaving patients in their rooms and send them to

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hospital?—Yes; they were all sent to hospital at the beginning of December, I think.

25,806. Under what system was there was most concealment?—When we sent them to hospital. The more you worry them the more they conceal cases.

25,807. Have you lately reverted to the system of leaving the patients in their houses?—Yes, without disinfection.

25,808. How long is it since you reverted to this system?—I suppose about three weeks or a month.

25,809. You do not disinfect now?—No.

25,810. What is the reason of that?—Because the disease is of such a virulent type. It is no good doing so. They are generally dead by the next day.

25,811. Is the type a little milder now?—Yes, during the last week it has become so. Some patients have lived for three or four days.

25,812. Do you now, in any cases, remove people to the hospital against their will?—At present, we only send those who are willing to go, but we try to persuade them all to go.

25,813. Do you find a certain number of people are willing to go?—Yes, some are willing to go. I find when I go on my rounds that many have gone to hospital. On the first day, when the patient is not delirious, they will not send him to hospital, but on the second or third day they want him to go. So long as the patients have only simple fever, they like to treat the case as such.

25,814. Do you mean the patients themselves are willing to go to hospital?—No; I mean the friends desire to send them.

25,815. Under the system of no one being sent to hospital, unless his friends desire that he should go, do you have much concealment of cases?—I think I find nearly every case now, unless there is sudden death. I can only do it privately. If I leave one case in a chawl then they show me the other cases. But if I did not leave that case they would conceal all the other cases.

25,816. Do you consider that in order to have any measure of success in Bombay, the confidence of the people must be acquired?—Yes, you ought to work with the people. The more you gain their confidence, the more they will help you, and the better all round. Only about 30 per cent. of cases are found now, whereas 70 per cent. die without your discovering them. The less stringent you are the more cases you find,—you would probably find 50 or 60 per cent.

25,817. Do you send any people to contact camps?—Yes, if we can find them, but they generally bolt.

25,818. Who are the people you send to contact camps?—When a patient dies of plague, the rest of the people in the room know you will go round and send them to contact camp, and by the time you get there they have bolted. They hate going to camp.

25,819. Why do they hate going to camp?—Contacts naturally hate going to camp; they like to go into another room. They are probably in the next room, if you could only find them; but it would take too much time to hunt up all the contacts. One is told that they have gone up country, when they are probably in the same chawl.

25,820. When you send them on to the Government camp, do you keep them there as long as they choose to stay?—No, only 10 days.

25,821. Do you think it is possible that the feature they dislike in going to a Government camp is the being turned out again after 10 days?—Yes.

25,822. Supposing you thought it wise to turn the people out of a chawl, how would you, yourself, think it best to treat them? Would you send them to a Government contact camp?—No; they do not like going to camp, because they are only allowed to stay there 10 days. If they have to go there they would like to stay there for a few months at least.

25,823. Do they like you to allow them to put up their own huts?—Yes, and that does not cost Government any money. I spent 300 rupees a day at one time, but now I do not spend anything on evicts.

25,824. Would the people think it a hardship to have to put up their own huts?—No.

25,825. Would they require the Government to provide materials for them?—No, because they do not pay rent if you give them a piece of land. They would be grateful for any assistance, but it is not absolutely necessary.

(Witness withdrew.)

(Adjourned till Monday, 20th March.)

At The Secretariat, Bombay.

SIXTY-EIGHTH DAY.

Monday, 20th March, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. *(President)*.

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX *(Secretary)*.

Major W. L. Reade, R.A.M.C.

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Major W. L. READE, R.A.M.C., recalled and further examined.

25,826. *(The President.)* We shall have to trouble you again for some further information with regard to Poona?—Certainly.

25,827. We wish to learn what has occurred in Poona with reference to the plague since we had the pleasure of seeing you there?—The disease has now been

stamped out. 26 cases of plague have been imported into Poona since 22nd of February. The type of plague imported is of extreme virulence. As an example of its intensity, I may instance the following:—A family of nine persons came from Bombay on 1st March 1899, and were under surveillance. One of the family died on the 4th March. On inspection by a medical officer the cause of death was pronounced as due to plague. Three other members were also suffering from plague, and the remaining members also showing signs of illness were admitted into the General Plague Hospital, when they all died, the last on the 10th instant. The virulence of the disease is also shown by the proportion of deaths to cases. To the 18th of March 290 cases have occurred, and of these 228 have already died; of the 26 imported cases of plague 24 have died. This importation of the disease is due to the large number of people who have come from Bombay, reaching Poona by rail and road. This influx from Bombay has been reported to me by the Plague Superintendent of the Station, who stated that two-thirds of the people from Bombay alighted at Poona. At Talegaon, a station 20 miles from Poona, where all Bombay trains stop, it has been reported to me by the Hospital Assistant on surveillance duty that a considerably larger number of people than usual have recently been alighting daily. The normal is about 200 a day, and latterly they have been arriving at the rate of 280 a day. There is little doubt that a large number of people come into Poona by road from this station in order to escape the restriction which they think will be imposed in Poona. On a house becoming infected, the inmates are sent to an observation camp where their clothes are disinfected and their names and thumb impressions are taken; these people are then allowed to carry on their ordinary avocations during the day and return at night to sleep. After four days' observation the names of the contacts are brought on the surveillance list of their Pet, where the remaining period of surveillance is undergone. Among the contacts 15 developed plague and nine died out of a total of 2,013 under observation, all these cases being within the incubation period of the disease. This is shown in the following statement:—

No.	Admitted Segregation.	Came from	Hospital.	Result.
1	14 February -	Budhwar, 348 -	18·2·99	Died.
2	23 „ -	Sadashiv, 649 -	—	Died in town 23·2·99
3	24 „ -	Vetal, 547 -	24·2·99	Died.
4	14 „ -	Budhwar, 348 -	20·2·99	Died.
5	24 „ -	Shukrawar, 1,500	27·2 99	Alive.
6	28 „ -	Kasba, 990 -	4·3·99	Alive.
7	28 „ -	Raviwar, 801 -	1·3 99	Died.
8	2 March -	Gunj, 763 -	6·3·99	Died.
9	5 „ -	Raviwar, 372 -	7·3·99	Alive.
10	5 „ -	„ †	8·3·99	Died.
11	5 „ -	„ -	9·3·99	Died.
12	11 „ -	Shukrawar, 1,590	13·3·99	Alive.
13	11 „ -	Sadashiv, 682 -	13·3·99	Died.
14	11 „ -	„ -	14·3·99	Alive.
15	9 „ -	„ -	16·3·99	Alive.

15 contact cases of plague, of whom nine have died.

Under the present system of house census a larger number of contacts in proportion to the number of cases were kept under observation, that is to say, the average number observed to each case of plague is now seven, whereas in the last epidemic it was three. The ratio of attacks amongst the contacts is now one in 134; in the previous epidemic it was one in 98. In no instance have we been able to trace any infection due to a want in the disinfecting process, or to the short period which elapses between the time of removal and the return of the inmates. Only in two cases were patients allowed to remain for treatment in their own houses; the result was so disastrous that the trial was given up. I am of opinion that unless a private house can be placed under the conditions of a plague hospital the treatment of cases in such houses should not be attempted.

25,828. Can you give us details about the two cases you refer to?—I have the history of two cases which were treated in their own houses, which I will read to you. "On the 20th of February 1899 a boy from house "No. 20, Shukrawar, went to house No. 284, Sadashiv, "and died there of plague. The next day, on 21st "idem, a woman in house No. 20, Shukrawar, was "attacked with plague and was allowed to be treated "in the house which was disinfected on the next day. On "the 24th the brother-in-law of the woman got ill and "was removed to the Sadashiv Pet Hospital, where he "died of plague on 26th February 1899." I should like to say with regard to this first one that it is not a desirable house, nor one which one would have sanctioned in the ordinary way. They said the woman was moribund. It is not a house one would deliberately have chosen.

25,829. In this particular case you left the patient there because she was moribund, and not because the house was a particularly good one to try experiments with?—Quite so. "At house No. 78, Shukrawar, on "the 13th of February 1899, one case of plague occurred "in the house. On 19th February a boy in the same "house got plague, and was allowed to be treated in the "house, which was disinfected the next day. The father "of the boy died of plague in the house on 24th February. "On the 27th the brother of the patient caught plague, "and was sent to the hospital, where he died. The "patient died on 1st March 1899. Next day the wife "of the boy's brother got plague and died the same day "in the Sadashiv Pet Hospital." My conclusions with regard to treating patients in their own houses are as follows:—I think that, unless it is possible to assimilate a private house to the condition of a Plague Hospital—it ought to be detached, or more or less detached—I do not think it is possible to treat any large number of people in their own houses. These two houses caused me a great deal of anxiety. One had to tell off a soldier to constantly disinfect the floors. I admit that the floors were properly disinfected, but one could not daily look after the infected clothing, and the hundred and one things which have to be done in a Plague Hospital. Then there is the question of a guard. As it is extremely difficult to place a house under the same condition as a hospital, personally, from the little I have seen, I do not think I should be inclined to recommend the system. In fact, in Poona we have practically done away with it, because it is impracticable.

25,830. Treatment in houses under any circumstances?—If you have a bungalow in a cantonment surrounded by a good compound, and there are reasons for it, say, in case of a native gentleman or a native noble of high rank, where the question of expense is a bagatelle, I think it is possible to do it, but I am sure you could not do it efficiently in the case of a large number of houses in a crowded town.

25,831. You say that the system is applicable only in those cases where there is a large compound and other conveniences, and therefore in a town, where some of the houses are better than the others, you think it would be inappropriate even for the better houses?—I should be inclined to lay down that the house must either be detached or semi-detached. I do not think that in a long row of houses it would be possible. Then there is the question of rat infection. If you have an infected house in the midst of a crowded quarter, you get infection carried by rats from that house to others. Even if you bring the house under the same conditions as a Plague Hospital, in the midst of a crowded town there are more rats than you would have in a hospital, in a more or less isolated place. We have evidence now with regard to rat infection, and it shows that within a small radius there is undoubted infection by rats, though a very localised one. Rat infection has not played a large part in the recent outbreak in Poona. As a source of infection to man it is one I have had little knowledge of up to the present date, but from our recent experience in Poona I incline to believe that the influence of this infection has been much exaggerated. In house No. 5, Shukrawar, three plague cases occurred, and on disinfection of the house, which was a grain shop, 25 dead rats were discovered in a heap on the floor of one of the rooms. A row of small houses adjoining this shop were also disinfected and no further cases occurred. On March 1st a family of nine persons came from Bombay and took up their residence at house No. 1622, Shukrawar, and were placed under surveillance. On the third day a child died, and in the same room eight other persons were found ill, all of whom were sent

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to the General Plague Hospital. The infection spread to house No. 1621, where four cases of plague occurred, three of whom died. In house No. 1623, 18 dead rats were discovered in a room on the ground floor. The house was disinfected. The inmates of this house, on discovery of the dead rats about 8th March, left the house, with the exception of the head of the family, my head clerk, who remained. He developed plague on the 17th and died on the 19th. No more cases of plague occurred in the neighbourhood of these houses. These instances are cited, as they go to show that infection by rats would appear to be of a local character.

25,832. Is that all you wish to put before us?—That is all.

25,833. (*Mr. Hewett.*) Could you separate the figures, so as to show the total reported cases of plague and deaths, and the total mortality, and the average mortality, from the time that we went to Poona up to now?—I have a statement of the actual total mortality from the 14th of February, which was the date of the outbreak, to the 17th of March, and also one showing the mortality for the same period in the years 1891 to 1895. They are as follows:—

MORTALITY.

STATEMENT of FIGURES of NORMAL and ACTUAL TOTAL MORTALITY from 14th February to 17th of March, during the Years 1891 to 1895.

Date.	1891.	1892.	1893.	1894.	1895.	Total.	Average of 5 Years.	Total, 1899.
14 February	5	4	1	4	8	22	4½	18
15 „	7	7	4	9	1	28	5½	22
16 „	3	9	25	4	13	54	10½	16
17 „	7	7	3	11	8	36	7½	20
18 „	10	7	4	9	17	47	9½	15
19 „	9	6	7	4	6	32	6½	18
20 „	6	10	9	13	10	48	9½	26
21 „	6	8	6	2	5	27	5½	16
22 „	4	6	9	4	9	32	6½	22
23 „	4	6	6	3	7	26	5½	17
24 „	6	7	5	7	29	54	10½	20
25 „	5	8	8	13	51	85	17	28
26 „	4	3	12	4	10	33	6½	16
27 „	4	6	23	15	9	57	11½	13
28 „	6	6	15	21	9	57	11½	34
1 March	15	9	5	3	8	40	8	25
2 „	5	13	4	1	6	29	5½	24
3 „	8	9	—	6	—	23	4½	25
4 „	5	8	8	4	8	33	6½	26
5 „	4	5	8	4	13	34	6½	20
6 „	6	5	9	5	7	32	6½	23
7 „	8	9	15	13	4	49	9½	27
8 „	4	7	4	4	15	34	6½	25
9 „	7	10	7	8	3	35	7	20
10 „	3	11	9	11	—	34	6½	29
11 „	9	—	11	12	14	46	9½	28
12 „	5	5	6	11	15	42	8½	17
13 „	3	1	9	10	8	31	6½	24
14 „	6	10	12	1	7	36	7½	20
15 „	6	13	7	17	2	45	9	27
16 „	7	9	7	4	9	36	7½	20
17 „	3	3	16	3	—	25	5	33
Total	190	227	274	240	311	1,242	248½	714

25,834. The total mortality is 714, compared with an average of 248?—Yes.

25,835. What was the number of ascertained plague deaths?—There were 290 cases and 228 deaths, according to the following statement:—

STATEMENT of RECORDED ATTACKS and DEATHS from PLAGUE from 14th February 1899 to 17th March 1899.

Month and Date.	Poona City.					
	Imported.			Indigenous.		Total.
	Cases.	Deaths.	Whence imported.	Cases.	Deaths.	Cases.	Deaths.
14 February	—	—	—	1	1	1	1
15 „	—	—	—	1	1	1	1
16 „	—	—	—	—	—	—	—
17 „	—	—	—	4	2	4	2
18 „	—	—	—	—	—	—	—
19 „	—	—	—	13	4	13	4
20 „	—	—	—	4	6	4	6
21 „	—	—	—	2	2	2	2
22 „	—	—	—	2	2	2	2
23 „	1	1	Bhore	6	7	7	8
24 „	—	—	—	9	8	9	8
25 „	—	—	—	9	4	9	4
26 „	2	1	Bombay and Bhore.	6	4	8	5
27 „	—	—	—	10	1	10	1
28 „	2	2	Bombay	13	8	15	10
1 March	2	2	„	6	6	8	8
2 „	1	1	„	15	12	16	13
3 „	1	1	—	12	12	13	13
4 „	—	—	—	16	15	16	15
5 „	4	3	Bombay and Kothrud.	4	2	8	5
6 „	1	1	Bombay	5	8	6	9
7 „	—	2	—	5	6	5	8
8 „	3	3	Bhore and Bombay.	6	5	9	8
9 „	—	—	—	7	2	7	2
10 „	1	1	Induri	10	5	11	6
11 „	2	3	Kudji and Bombay.	11	11	13	14
12 „	1	—	Sholapur	7	10	8	10
13 „	1	—	Jintia	7	5	8	5
14 „	2	1	Bombay and suburban limits.	11	9	13	10
15 „	—	1	—	16	15	16	16
16 „	—	—	—	16	7	16	7
17 „	—	—	—	15	11	15	11
18 „	2	1	Bombay and Loni-Kalbhor.	15	13	17	14
Total	26	24	—	264	204	290	228

25,836. The number of ascertained deaths from plague amounts to half the excess mortality?—Yes.

25,837. (*The President.*) How do you account for the other deaths?—During January and February we have had an extremely virulent outbreak of measles and influenza—diseases, more particularly, which cause bronchial affections among children.

25,838. Has the mortality among them been excessively large?—There were 208 deaths among children under the age of five in January.

25,839. What was the ordinary average in other years?—Fifty-nine.

25,840. (*Mr. Cumine.*) As regards the two instances which you gave us of treating plague patients in houses, did you give them to us because they are the only two instances, or because they especially illustrate the danger of leaving patients in houses?—They were the *only two* cases that were treated so.

25,841. As a rule you remove all patients, except the moribund, to hospitals?—Yes.

25,842. Do you find that the knowledge of the fact that patients will be removed to hospital produces concealment of plague illnesses?—I do not think so,

when the case is known to be plague. Directly a case is diagnosed as plague the relatives are very anxious to get rid of it in Poona. If you go to a house and say it is a case of fever, they say, "Will you leave it until "definite symptoms have come on"? But if you say it is a case of plague you never have any difficulty. They are generally quite ready to have the person removed. We have generally explained to them that even if it is a case of fever it is very necessary that it should be under observation. Directly any definite symptoms develop there is never any further argument. That is the general rule.

25,843. Do you find that the people conceal the illness as long as possible, or do they report it as soon as it appears, even though it has not shown definite symptoms of plague?—Latterly they have done so. On the other hand, we have certainly had a great many corpses in the town; but I have attributed that a great deal to the extreme virulence of the disease. The ordinary history of an attack would be this: The man would be apparently pretty well in the morning; he is attacked in the afternoon; and is dead either the same evening or on the following morning. We have had very numerous instances of that kind.

25,844. In the two cases where you left the patients in the house, did you put them upon beds, or did they lie on the floor?—In both cases, which were sanctioned, as it were, officially, the patients were on the floor.

25,845. Did you give them any pans of disinfectants for the sputum and excreta?—Yes, we gave them everything we could in that way. I was extremely busy during that period. I told off a soldier to go there, and gave him directions what to do. Of course, I cannot answer for personal supervision. I can only say that the instructions I gave were carried out by the soldiers as far as possible. Even with this precaution the cases caused me great anxiety.

25,846. Were directions given to sprinkle disinfectants upon the floor daily?—I tried to take all the ordinary precautions that are taken in a Plague Hospital.

25,847. Do you find that plague reappears among the contacts on their return to sleep in their houses after 10 days?—I have not had a single case beyond the incubation period.

25,848. Before they are allowed to return, that is to say, in the course of these 10 days, has the room where the case occurred been disinfected only on one occasion or repeatedly?—Only on one occasion.

25,849. (*Prof. Wright.*) Of the 290 plague cases that have recently occurred, do you know how many were derived from plague existing in Poona when we were there, and how many were derived from freshly-imported cases?—To put it roughly, each imported case would do a certain amount of damage. We have the evidence I have given you of one child coming into a house.

25,850. When we were in Poona there was one focus of infection, which had been caused by an imported case; since then there have been a great many imported cases, and, of course, you have to deal with these new foci of infection. Can you find out how many of these 290 cases occurred in houses in which imported cases died—and how many have occurred in houses into which no imported cases can be traced?—It is not possible to get the information even approximately. The imported case on 14th February 1899 was the cause of 25 attacks before the disease was stamped out of the infected quarter.

25,851. Your excess mortality was 228 cases due to plague, and 238 deaths which were not due to plague?—Yes.

25,852. The latter 238 cases would labour under the suspicion of being plague cases?—Yes.

25,853. Could you rebut that by showing that very few plague cases originated in those houses in which the 238 deaths occurred which you do not attribute to plague? I want to find out whether there were any deaths from plague, or whether cases of plague subsequently occurred, in these houses which were not disinfected because the deaths that occurred in them were regarded as non-suspicious deaths?—I put in a statement, as follows:—

Pet	Number of Houses in which suspicious Deaths occurred from 1st December 1898 to 28th February 1899.	Number of Houses in which occurred ordinary Deaths from 1st February 1899 to 15th March 1899.	Number of Houses in Column 2 in which Plague subsequently occurred.	Number of Houses in Column 3 in which Plague cases subsequently occurred.	Time which elapsed between the suspicious or ordinary death and the plague death.		
					Under 10 days.	Under 15 days.	Over 15 days.
1.	2.	3.	4.	5.	6.		
Gharpode -	1	13	—	—	—	—	—
Nyhal -	1	8	—	—	—	—	—
Raste -	1	16	—	—	—	—	—
Bhamburda	1	21	—	—	—	—	—
Naragon -	2	15	—	1	—	—	—
Nana -	7	41	—	2	—	1	1
Gunj -	9	33	—	1	1	—	—
Somwar -	1	24	—	—	—	—	—
Mangalwar	1	9	—	—	—	—	—
Budhwar -	8	34	1	2	—	—	2
Shukrawar	14	81	2	5	3	—	3
Shanwar -	6	53	—	—	—	—	—
Raviwar -	11	74	2	10	10	—	2
Ganesh -	5	30	—	—	—	—	—
Kasba -	13	95	—	—	—	—	—
Vetal -	5	24	—	1	—	—	1
Bhawani -	6	27	—	—	—	—	—
Sadashiv -	10	44	2	7	5	1	3
Mustfer Ganj.	—	2	—	—	—	—	—
Total -	102	549	7	29	19	2	12

25,854. Are the contacts only kept under observation?—They are sent to camp, where their clothes are disinfected; then they are allowed back to their houses, but they must return to camp at night.

25,855. How soon are they allowed to go away entirely from the contact camp?—After three days they are put on the "contact surveillance register" of the Pet they live in. We make a person sleep for three nights in camp, and then a notice is sent to the Chief Volunteer of his Pet: "This man is transferred from "the observation camp; take him on the surveillance "of your Pet."

25,856. (*The President.*) Under what circumstances have you had to re-disinfect a house?—If one of the people during the period of observation developed plague, the house would, of course, be re-disinfected.

25,857. That is to say, a person who had access to one of these disinfected houses is sometimes found to develop plague, and in that case you have to disinfect the houses?—If a person develops plague after an original attack the house is again disinfected. A family, we will say of five people, are sent to the observation camp. Two days after observation one of them is found suffering from plague; he is sent to the Plague Hospital and his house is again disinfected, as he is one of the family of the same house.

25,858. Has that person been in that house which you are going to re-disinfect, or has he been in the camp all the time?—He has slept in the camp at night and in the day time been in the house, and after three days he is allowed to occupy the house day and night.

25,859. At what intervals after the houses are re-entered have attacks occurred?—Attacks varied from the first day up to the sixth.

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25,860. What has been the progress of the plague on the occasion of the third outbreak here? Is it extending rapidly or slowly? Would you have expected it to extend more rapidly, or has it extended in the same way as in the first and second epidemics?—I consider the feature of this outbreak is its very rapid spread, in fact it is quite different to the former outbreaks in Poona, and all outbreaks of plague of which I have had experience. The cause of this outbreak, an imported case from a Bhatia's family, infected 25 other cases in a few days' time, before it was possible to stamp the disease out of the infected quarter. One of the prominent features of this disease, *i.e.*, its slowness of progression, has not been found true in this outbreak. The second and also the present epidemic of plague in Karachi may be cited as evidence in corroboration of this statement. It would appear that the disease, having once got a favourable soil for its propagation, increases in virulence with every repeated outbreak. The recent outbreak here is the most virulent type of the disease that I have seen.

25,861. You have, however, the advantage of the circumstance, that you are now dealing with plague at the commencement of the hot season?—Yes.

25,862. Is it not a fact that at that time you generally have found that plague does not extend very rapidly?—At Karachi they had a virulent outbreak in very hot weather.

25,863. What has been your experience at Poona in the previous outbreak?—The 1896-7 outbreak was got under before the end of May.

25,864. That is to say it subsided in the hot season?—It commenced earlier than on the present occasion.

25,865. I believe you have had a great deal of voluntary co-operation in Poona?—Yes, a very large amount.

25,866. Is that more intelligently and more effectively being applied during this third epidemic than during the previous epidemic?—I think it is very much. All the Pets showing the best results and the best organisation are those in which voluntary agency is more largely represented.

25,867. Do you attribute some of the relative success in dealing with the epidemic on the present occasion to the greater efficiency of voluntary co-operation?—Certainly, I do.

25,868. How do you account for this voluntary co-operation being now more effective, efficient, and hearty than it had been on previous occasions?—I think it has only been developed towards the middle portion of the last epidemic; ever since then it has been kept up. In the first epidemic there were volunteers, but there was practically no voluntary organisation.

25,869. At the same time I suppose the people in Poona have more true information than they had before as to what your aims are, and what plague means?—Certainly they have.

25,870. And they have reason, therefore, more heartily to co-operate?—Yes.

25,871. They know that whatever you are doing is being done as far as possible for their good?—Yes.

25,872. They appreciate that?—I think they do.

25,873. I suppose while the epidemic is going on you cannot give any decided view as to the success of your methods?—I think they are extremely hopeful.

25,874. You appreciate the fact, however, that the epidemic is now decreasing?—I do not say that. Until it diminishes in Bombay, of course, we have to look out for a great many imported cases. I think we have been able to cope with our imported cases, and the amount of infection which has spread from them.

25,875. But your information has not been enough to enable you to judge absolutely?—No, I could not say that.

(Witness withdrew.)

Mr. S. R. Arthur, I.C.S.

Mr. S. R. ARTHUR, I.C.S., recalled and further examined.

25,876. (*The President.*) I believe you wish to give us some information in addition to that which you gave in your examination here on the 11th of February?—Yes, regarding inoculation in the Kolaba district, of which I am, at present, Collector.

25,877. (*Prof. Wright.*) Would you describe the circumstances under which the inoculations were done?—Yes. Inoculation was commenced at Alibag on 2nd February 1899.

25,878. What is the population of Alibag?—According to the last census, the population of Alibag is 5,888, but owing to the visitation of plague in two consecutive years I think it is probable that, even before the present attack, the population was less. The average population is now about 5,000, I should think. Since the inoculations commenced 1,385 persons had been inoculated, men, women and children, including old men up to 90 years of age, and infants two months old. The present attack commenced on the 24th December, and was heralded by a mortality among rats. As far as I have been able to ascertain, the disease was not imported, but started spontaneously, presumably from last year's germs which have meanwhile remained dormant. On the first cases occurring there was a considerable exodus of well-to-do people, including nearly all the non-official Municipal members. At the beginning of February 1898, I issued an order that no one uninoculated should sleep in the town at night, and that those who did so would be prosecuted if discovered. Latterly, the greater part of the population have been encamped in huts outside the town. When inoculation was first introduced the people were much afraid of it, and all sorts of rumours as to the evil effects of inoculation were in circulation. The results, however, have been so successful that I think this fear is now entirely removed. I will now lay before the Commission a few of the most striking instances of the immunity enjoyed by the inoculated as compared with the uninoculated. The first instance I can give is this: On 21st February there were in the Police Lines about 130 inoculated persons, and about 21 uninoculated. They were being gradually inoculated, but these 21 had remained till the end. One of these, Rakmi, wife of Gangnak, Head Constable, was attacked with plague on the above date and died on the 22nd. Another, Rama Shripatrao Sinda, was attacked on the 18th and died on the 24th—two cases. The remaining persons then uninoculated were inoculated within the two or three days following, and though 150 persons have since been living in the lines, and are living there now, there has only been one other case of plague there. This was Parbati, wife of Ragnak Rannak, who, having been inoculated a fortnight previously, was attacked with plague on the 8th of March. She had high fever one day, was better the second day, and on the third day she was almost well; and within a very few days was restored to perfect health. Beyond that there has not been another case in the Police Lines.

25,879. Are these police lines situate in an infected quarter?—Yes. It was the place first attacked. It was attacked last year also. The second instance I wish to bring to notice was also a striking one. A Koli family of seven members was living in the town, of which six members had been inoculated in February. The remaining one, Hasu, wife of Nathu, having been delivered of a child only two months ago was uninoculated. She caught the infection about the 8th instant, and died on the 14th in hospital. None of the other members of the family were affected, and the child was weaned from her, inoculated, and is now thriving. The third instance is also that of a Koli family of three members living together in the town. Of these, two were inoculated on the 9th and 17th February respectively. The third, a little girl of 12 years of age, who was to be inoculated later, was attacked with plague on the 1st instant, and died on the third. The other two members were not affected. The fourth instance is that of a family of goldsmiths living in the town. Govindshet was inoculated in February. His daughter. Rembai (uninoculated) was attacked on the 7th instant, and died on the 8th. His wife, Bhagirthi, was inoculated the same day, and has not been affected. The fifth instance is that of a Musalman family of eight; of these, three were inoculated in February.

Ismail, the son of one of them, eleven years of age (uninoculated), left Alibag on the 2nd and showed symptoms of plague on the 4th. He died on the 14th. The remaining members of the family were inoculated on the 4th, and none of the seven members now remaining have been attacked.

25,880. (*Dr. Ruffer.*) Had they been inoculated before that first case or after?—Three were inoculated before, the remainder were inoculated on the case occurring. When inoculation was first introduced in Alibag, I did not allow the members of affected families to be inoculated, lest the plague should be incubating in them, and lest their death from plague should be wrongfully ascribed to the effect of inoculation, but latterly, inoculation having become more popular, I have revoked this order, and have allowed the families to be inoculated, and have then allowed them to go to their homes instead of being segregated. Sixty-seven persons, who would otherwise have been segregated as contacts have been set free, and there has not been a single case of plague amongst them. The experiment was, perhaps, a somewhat hazardous one, but it has, I think, been justified by the result.

25,881. (*Prof. Wright.*) Have you any figures to show how many cases you expected among these 67 contacts?—I could not say how many, but I should certainly have expected some cases in the ordinary course.

25,882. Is that an inference from what you have seen in other contact camps? — Yes. Generally some members of the family are attacked here and there; but the fact that among the 67 not one was attacked seems to be extraordinary, and I ascribe their immunity to inoculation.

25,883. In your case these contacts are left in the houses?—They get a certificate from me that they have been inoculated, and they are allowed to go where they like.

25,884. They are not removed from the source of infection into camp?—No. They were exactly where they were before. Among the whole of the inoculated population of Alibag there have up to date been five deaths. Of these, three have been certified to be due to natural causes, while two have been due to plague. Of the latter, both were attacked within eight days of inoculation. One, Natu Koli, was inoculated on the 10th, had high fever with perpetual vomiting for three days and died on the 13th, three days afterwards. He had no buboes, but as there were two deaths among the uninoculated near his hut, just before, it is almost certain that he died of plague contracted prior to inoculation. The other person who died of plague after inoculation was one Balaji Bandhari. He was inoculated on the 5th, attacked with plague on the 12th, and died on the 14th. Other cases occurred in the neighbourhood among the uninoculated, and it can be taken as probable that he had caught the infection prior to inoculation. The total number of attacks and deaths from plague in Alibag since the 24th of December is 71 and 61 respectively, and, if the period up to 31st January be excluded, for the remaining period they number 54 and 47 respectively. If the fact that I ordered the evacuation of Alibag by all persons not inoculated at the beginning of February—that subsequent to that a very small proportion remained, and that a few prosecutions reduced even that small proportion—be taken into consideration, it will be seen that the mortality among the uninoculated living in Alibag has reached a somewhat high percentage. And yet, at the present time, some 700 uninoculated people are living in the town with impunity. I think the above recorded facts testify strongly to the value of inoculation.

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25,885. You are not able definitely to get at the numbers of the uninoculated living in Alibag?—There cannot be more than a very few indeed. I went round the town myself at night about a month ago. I think we got 40 people then.

25,886. You think there may be a hundred or two?—I do not think there are anything like that. Four persons were prosecuted, and since then I think there are very few indeed—mostly those remaining are uninoculated members of families which are undergoing inoculation, and who will be inoculated afterwards. I should not think there are more than 20 people in Alibag now who are not inoculated.

25,887. (*Dr. Ruffer.*) Is plague going on now?—Yes.

25,888. Then plague must be going on amongst the inoculated, if they are all inoculated?—Cases are now occuring principally among people in the huts outside Alibag.

25,889. (*Prof. Wright.*) Now and then every day or two, you get a case amongst the uninoculated people remaining in Alibag?—Yes, up to the last few days.

25,890. Did you get very severe symptoms sometimes after inoculation which frightened the people?—No, mostly not. There was high fever often for one day. Generally, the fever subsided in 48 hours. Of course those inoculated had swollen arms for some little time. One man had very high fever and required some attention for three days. He has recovered completely. I am not aware of anyone having suffered from inoculation.

25,891. Have there been any cases in which there has been very little reaction?—Yes, I have heard of such cases: chiefly old men and little children who were given less doses.

(Witness withdrew.)

Lieut.-Colonel E. LAWRIE, I.M.S., recalled and further examined.

Lieut.-Col. E. Lawrie, I.M.S.

25,892. (*The President.*) There are one or two matters on which we desire some further explanations from you?—Yes.

25,893. (*Dr. Ruffer.*) Do you wish to add anything to the evidence which you gave in Hyderabad—to the first proof of your evidence which was sent to you?—I have had a second proof sent to me, and I do not wish to add anything to that.

25,894. We examined Dr. Mullunnah with regard to a "Memorandum on experiments on rabbits with "Haffkine's fluid, performed by order of the Plague "Commissioner, Hyderabad."* I only want to ask you one question about that. In paragraph 6 of your statement you said, "The effects of inoculation of the "sterilised fluid in rabbits, and also, as far as our "limited experience goes, in man are simple. It "produces 'reactionary' fever alone without, as a "rule, any evil consequences. The question is, What "is this 'reactionary' fever due to? There can be "little doubt that it is due to plague." Will you tell us the reasons why it is due to plague?—I do not see what else it can be.

25,895. You say, further on, "One of us, Mullannah, "says it is due to the plague toxines"?—My opinion is that it produces a mild attack of plague. He preferred to put it that it was due to the plague toxines, and as he objected to put it my way, I put in his statement as well as my own.

25,896. What evidence have you got to show that it is plague?—It is not curative at all; there is no evidence except the effect that it acts as a prophylactic.

25,897. Supposing you take another disease—supposing you take diphtheria, for instance, and supposing you filter a culture of diphtheria, or sterilise a culture of diphtheria by carbolic acid, you get a certain amount of immunity, but you would not say you gave the animal diphtheria?—What else would the immunity arise from? You mean the products?

25,898. Yes?—But do not they necessarily produce the disease?

25,899. Not necessarily. It does not produce the disease. You would not say that animal had diphtheria, would you?—I should say if it was produced by the toxines, that it would be a modified form of the disease.

25,900. In the same way you say it is a modified form of plague?—Yes.

25,901. But you do not find the plague bacillus?—No.

25,902. So that this form of plague could not be contagious to other persons?—I should think not.

* *See* Appendix No. LXIX. in this Volume.

Lieut.-Col. E. Lawrie, I.M.S.

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25,903. I also want to ask about cotton. We have had it in evidence from Dr. Mullannah, that, in his opinion, he was not able to isolate the bacillus of plague from the cotton he examined. Are you still of the opinion that the bacillus that was isolated was the bacillus of plague?—Yes.

25,904. Why do you think so?—Because it had exactly the same appearance as all the other preparations of the plague bacillus that I have seen.

25,905. You have based your diagnosis on the microscopical examination alone?—I did not see anything else. I know that he was not able to propagate the bacillus afterwards, but I also know that in this cotton, in which he got the bacillus, there were numerous other organisms; and I thought it was quite likely on that account that it was not susceptible to propagation.

25,906. He was unable to reproduce plague with this?—Yes.

25,907. So that the only evidence of plague you have got so far is the microscopical appearances of the culture?—And the death of the rabbit in which the plague bacillus was found.

25,908. In which that bacillus was found?—What I called the plague bacillus.

25,909. Do you think that is sufficient to make a diagnosis of plague?—It satisfied me completely at the time, but I reported the matter to the Commission for further investigation.

25,910. (*Mr. Hewett.*) When you were before us before, I asked you a question as to railway inspection, and I asked you to provide the figures from the 1st of October, showing the number of persons examined, and the number of persons detained, and the number of persons who developed plague in each case?—Yes.

25,911. Dr. Mullannah produced a statement (*see* Question No. 5,789) the other day—I do not know whether it was on your authority—in answer to that question?—I believe the number of passengers was omitted in that.

25,912. Will you supply us with that information?—Yes. It was subsequently intimated that all through passengers, as well as those who alighted at stations, were examined, but as no record of the number of through passengers is kept, the number of persons examined cannot be exactly stated. It is estimated that not less than 12,000 persons are examined during the month, making a total of 180,000 in a year and a quarter.

25,913. (*The President.*) I want some information from you with regard to the progress of plague now in the Hyderabad State?—We have got a hundred villages infected in the Naldrug, Gulburga, Lingsagur, and Kopbal divisions.

25,914. Is it increasing or diminishing at the present stage?—A lot more villages were infected in the last cold weather, but the villages that are infected we have now got well in hand, and it is not spreading.

25,915. What is the condition of plague in Hyderabad city itself?—There has been none in Hyderabad city.

25,916. How do you account for the non-appearance of plague in Hyderabad city?—We have had pretty strict detention on the railway, and the roads from the infected areas are so bad that infected people cannot travel into the city.

25,917. It is therefore very easy to isolate the city?—Yes, comparatively.

25,918. Of course, people are entering the city constantly from the outside, and I suppose from infected areas also?—They do, but if they come from infected areas they are nearly always detained at Gulburga or Raichur, and if they come into the city they are kept under observation for 10 days.

25,919. How long has plague been prevalent in the Hyderabad district?—Since December 1897.

25,920. So that these measures which you have adopted have been all this time successful in preventing indigenous plague in Hyderabad city?—Yes, they have so far.

25,921. Are these measures which you have just stated all the measures in force for protecting Hyderabad, or are there any others?—We have this cold weather, as we have had in the previous cold weather, patrols on all the roads; that is to say, every road leading from Hyderabad to the infected areas has been patrolled, and the villages on either side of the road have been searched throughout the whole area leading from Hyderabad to the infected frontiers.

25,922. You have practically a cordon round Hyderabad?—We have got that ready to put on, but it has not been put on yet, because there is no plague in the villages round Hyderabad between it and the infected areas.

25,923. How many are there on each patrol?—There are eight parties, each consisting of one Medical Officer, and one Commissioned Officer, and from 5 to 10 sepoys. The previous year we sent out parties of sawars—that is, cavalrymen—but we found that those men did not do the work so well as the infantry, so this year we have changed them to infantry.

25,924. Are they in charge of the medical men?—Each party is accompanied by a medical man.

25,925. Have they been successful in discovering plague cases?—No, they have not discovered a single case.

(Witness withdrew.)

Major W. B. Banneman, I.M.S.

Major W. B. BANNERMAN, I.M.S., recalled and further examined.

25,926. (*Prof. Wright.*) I believe you have some facts to tell us with regard to the results of inoculations on the 26th Madras Infantry?—Yes.

25,927. Would you describe the condition of the regiment when you went down to inoculate it?—I arrived in Belgaum on the 23rd of December 1897, and the inoculations were begun next day. I found the whole of the regiment in camp round about Belgaum, some on one side of the town, and some on the other.

25,928. Why had they moved out into camp?—Because they had been so badly attacked by plague. Within the previous six weeks they had had 78 cases with 49 deaths, and on account of this they had gone out into camp—they had vacated their lines.

25,929. Had they been long in camp when you went there?—The whole of them were out by the 23th of November. I arrived about a month afterwards—the 23rd of December; so that they had been out in camp some weeks.

25,930. This large mortality that you spoke of occurred before they moved out into camp?—Not the whole of it. The first recognised case of plague in this regiment occurred on 12th November 1897, in the person of Private 2,224. Govindasami, who died the same day. Next day another sepoy was attacked, and also died. On the 15th a drummer was attacked; on the 17th the disease appeared among the followers, a bhisti of C Company succumbing on that day. By the 21st November 13 attacks had been reported from the lines, four of these being among the sepoys. On the 22nd, B Company went into camp, followed on the 23rd by C and G, and portions of A, D, and F Companies. By the 28th the whole regiment was in camp, and the lines were being disinfected. During this transition period 15 more attacks took place, six being among sepoys. In the 10 days following removal to camp 13 sepoys and 21 among families and followers were attacked. Then the cases fell off after that, and there were only one or two cases occurring in a week by the time I arrived.

25,931. The epidemic was practically over then before the inoculations began?—Yes.

25,932. Will you describe your inoculations. Did you inoculate everybody in the Regiment?—With the exception of some 81. I operated on 1,665 out of a total population of 1,746. Those were all operated on, and the Regiment then immediately went back to their lines, the lines in the meantime having been disinfected. After the inoculations were complete, that is, on the 6th of January, they had two attacks during the first epidemic in Belgaum, one in a sepoy, and one in an European Officer.

25,933. Were those among the inoculated, or the uninoculated?—They happened both to have been inoculated, but these were the only attacks after the inoculations were complete. These both took place in January.

25,934. These were two inoculated persons?—Yes. There were none among the uninoculated. There happened to be 81 uninoculated, but for the next six months there were no more cases among either group. From the figures that I got from Colonel Peters, Civil Surgeon of Belgaum, of the deaths in the city and cantonment, the epidemic seems to have been at its height in January, that is, in the month when they had only these two cases in the Regiment. Then the epidemic gradually died out, till, I believe, in May there were no cases at all. Then the second epidemic began in June. It became pretty bad in July, when there were 215 deaths among the civil population. In July there was only one death in the Regiment, a sepoy, who had been inoculated in December.

25,935. What is the population of Belgaum?—I am not quite certain, but I think about 38,000 or 40,000, if I remember rightly. Then, in August, there were two cases, and in September there were two cases.

25,936. All these among the inoculated?—The two who were attacked in August were both inoculated. In September two also were attacked, one inoculated, and one not inoculated. Then in October there were four cases.

25,937. Were these among the inoculated?—They were all inoculated, except one. Then in November there were two cases, one inoculated, and one not inoculated. In December there was one case of an inoculated man. These were all the cases that occurred in the Regiment during this second epidemic.

25,938. Do you know how many there are altogether from January onwards? There were three cases among the 81 uninoculated; is not that so?—Yes, three cases.

25,939. I want to know the total mortality in the Regiment, amongst inoculated and uninoculated, so as to compare the figures?—Amongst the inoculated there were 11 cases with three deaths; in the uninoculated there were three cases with three deaths, that is, 14 cases altogether. During the second epidemic there were 1,801 people inoculated.

25,940. You re-inoculated them?—They were re-inoculated at the end of August. The second inoculations began on the 18th of August, and were complete practically by the beginning of September. Between September and November various people were inoculated or re-inoculated as they came back from furlough, or from recruiting duty, or as families came in that had been away during the first inoculations. After the second inoculations there must have been very few inhabitants of the lines who had not been operated on. Less than the 81 left after the first inoculations.

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25,941. Did you do these re-inoculations?—No.

25,942. Do you know why they were undertaken?—I believe because the sepoys wanted it themselves. I spoke to a number of sepoys and Native Officers recently when I was up there, and they told me that they were just waiting for a third epidemic to break out to be inoculated for a third time.

25,943. The symptoms are not sufficiently severe to frighten a soldier off from re-inoculation?—No.

25,944. Did you see any bad results in those first inoculations among the sepoys?—No.

25,945. Did you see them after inoculation?—A great majority of them I did.

25,946. Those are all the pertinent facts, are they not?—Yes, I think so.

25,947. (*Dr. Ruffer.*) As I understand, the Regiment was first evacuated, then inoculated, and then allowed to go back?—Yes.

25,948. How many cases did you get between the evacuation and the return to the lines?—On the 22nd of November the Regiment began to go into camp. The evacuation was complete by the 28th. During this transition period 15 more attacks took place, six being among sepoys. In the next 10 days 34 cases occurred, and before the return of the Regiment to the lines was complete 16 more were attacked, making altogether 78 cases from the commencement counting the 13 which occurred before removal to camp.

25,949. How many attacks were there among inoculated people?—There were not any inoculated at that time. The inoculations did not begin till about a month afterwards.

25,950. How long after the inoculation was finished did you allow the people to go back?—They went back at once—the next day.

25,951. But the houses had been evacuated for about two months before they were allowed to return to them?—The houses were evacuated on the 28th of November, and they were all back by the 30th of December. They had been empty for a month.

25,952. Had they been disinfected?—Yes.

(Witness withdrew.)

Dr. D. GALEOTTI recalled and further examined.

Dr. D. Galeotti.

25,953. (*The President.*) I think that you expected, on appearing before us for further examination, to give us some notes of experiments on animals with serum obtained from five horses which had been immunised in Florence by Professor Lustig?—I spoke to Professor Lustig when he came here, about this, and he told me that he had sent to the Municipal Commissioner a memorandum about this thing. I think the Commissioner has the memorandum, and I cannot say more.

25,954. This memorandum does not contain any details; it only summarises some of the experiments, without any details. These experiments were not made by you?—No.

25,955. So that you cannot give us any further information than is contained in this report?—No.

25,956. Perhaps you will put in this statement in your evidence?—Yes, it is as follows:—

MEMORANDUM BY PROFESSOR LUSTIG, ADDRESSED TO THE MUNICIPAL COMMISSIONER, BOMBAY.

"1. Having obtained from the Italian Government leave only up to the 10th of February, I must start from Bombay, and I regret it is impossible for me to give my evidence to the Plague Commission.

"2. I beg to forward to the Commissioner a memorandum giving briefly my opinion on the different subjects on which I have been requested to express my views.

"3. Further explanations can be given by my Assistant Dr. Galeotti, Lecturer at the University of Florence, and by myself by letter, if the Commission find it necessary.

"4. The aim of my coming to Bombay has been to pay a visit to the laboratory arranged by my Assistants, Drs. Galeotti and Polverini, and to have personal information of the arrangements for the preparation of the curative serum.

"5. I am very pleased to be able to express to the Commissioner that I have found the work of Drs. Galeotti and Polverini completely satisfactory in every regard, and I should be very glad if the Plague Commission would pay a visit to this laboratory, and examine the operations for the preparation of the serum, and the experiments for the immunization of horses and other animals.

"6. Now it will be seen, from the several works published by myself and Dr. Galeotti in different and scientific papers, that we had in our researches the object of extracting from the plague bacilli a very active substance of known constitution able to induce in the animals, in which this substance has been injected, a strong local and general reaction, by means of which the serum of the blood of these animals attains specific bactericidal and antitoxic properties.

"7. Our experiments were, in the beginning, performed on animals (rabbits, rats, guinea-pigs, monkeys) and later on (July and August 1897) in Bombay and Poona with a serum prepared in Florence. With this serum we treated 30 patients in different stages of disease, and of these, 24 recovered.

"8. In February 1898, I was charged by the Bombay Municipality to prepare serum in my laboratory at Florence, and to send it here for the treatment of the plague patients in the hospitals of this town.

"9. Every time, before the sending out of the serum, I tested its preventive and curative power on rats, injecting them in the peritoneal cavity with a small quantity of a very virulent plague culture.

"10. I did not determine the minimum curative doses, because I think that such determinations have

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no conclusive value, it being impossible to have a standard of the strength of the injected virus.

"11. I can only say with certitude that ½ or ¼ c. c. of serum was able to save a white rat of 100 grammes weight, if the serum was injected under the skin, two or three hours after the intraperitoneal infection with cultures able to kill rats in 12 to 18 hours.

"12. These experiments show that the serum of the No. 4 horse was the most active and that of the No. 1 horse was the weakest.

"13. The results are in accordance with the experiments made with the same serums on plague patients.

"14. With these experiments the Plague Commission have been acquainted by Dr. Galeotti and by other witnesses who had occasion to examine the treated cases, and it would be useless to report these results.

"15. Now I have found the horses treated by Dr. Galeotti in good condition, and I hope they will give an active serum.

"16. The first essays made by Dr. Galeotti on the rats gave very satisfactory results, and these results will be communicated to the Plague Commission, together with those of the following experiments by Dr. Galeotti himself.

"17. In accordance with my personal experience on the preparation of the curative serum in general, and specially in regard to the preparation of the anti-plague serum, I must say that not all the horses are able to give a serum endued with sufficient curative properties, and that some horses are able to give a good serum, only after a long process of repeated inoculations.

"18. I believe that the strength of the serum prepared, following my method, is due to the presence in the blood of substances elaborated by the cells of the organism of the horses, during the general reaction which follows every inoculation.

"19. When the activity of the serum is in good proportion to the No. 1 strength of these reactions, the horses able to give strong reactions will furnish surely an active serum.

"20. On the contrary, the horses in bad condition of nutrition and in which the material exchange is abnormal, show, after the inoculations, phenomena of impoverishment and torpor, and are not able to give a sufficiently strong serum.

"21. For this reason, it is necessary to keep the horses quiet for some time after the first blood letting and before making the inoculations.

"22. I have requested Dr. Galeotti to give to the Plague Commission the most detailed information about the experiments which will be done on plague patients with the serum of the horses which are now under treatment, and also, in regard to the researches designed, to determine on rats, with the greatest exactness possible, the strength of the serum of every treated horse.

"23. Being requested by the Municipal Commissioner to express my opinion on the importance of rats in the diffusion of the plague, I offer the following:—

"1st. I have performed experiments on hundreds of rats of different races, and living in the most different conditions, and I have found that almost all are able to get plague.

"2nd. Keeping in a cage several infected and non-infected rats, all die in a short time, and in their bodies plague microbes are always to be found.

"3rd. Mixing a virulent plague culture with the food given to some rats, all these generally die from plague, and it is quite common to find the bacilli in their fæces.

"4th. Generally, in the infected rats, the microbes enter the blood, and with great facility they pass into the urine. Thus this urine becomes a very infectant liquid.

"5th. In 1897, I had occasion to examine at Poona some dead rats found in a granary, and in these I found plenty of microbes. I investigated also the corn of this granary, but I did not discover any plague microbes in it. Nevertheless, I know that two cooks who ate of this corn died from plague a few days after.

"6th. I believe that the rats represent one of the important means of diffusion of the disease, because they are able to carry everywhere virulent microbes.

"7th. That the destruction of the rats is one of the most important measures to be taken against the plague. For this purpose poisons can be very useful, and specially would it be useful to provoke amongst the rats another epidemic, with a microbe not virulent to man. For this purpose, I believe that the Laser's microbe would be the best, because it was used with satisfactory results in Thessalia some years ago. I got a culture of this microbe and tried it on white mice, and obtained a culture which was very virulent, but I had not success into the black rats. I know that the same was experienced by Dr. Galeotti, to whom I sent one of my cultures of Laser's microbe. Dr. Galeotti will receive in a short time from Prague another more virulent culture of the same microbe, and will repeat the experiments."

25,957. I think you spoke previously of 24 patients who had been treated at Poona with the serum, but you were not then able to tell us what was the nature of the individual cases, whether they were mild, or whether they were severe, or at what stage in the course of the disease the serum treatment had been adopted. Can you now give us these points of information?—I was not in Poona, and I had only had verbal information from Professor Lustig, and he told me that the cases were of different strength. Some of them were very serious, and some not very serious, and that for the most part they were all of the bubonic form, one or two being of the pneumonic form.

25,958. You cannot say anything more definite; you have only got the information from another source, not from your own observation?—That is so.

25,959. I think you also told us that you were then engaged in endeavouring to produce a more active curative serum?—Yes.

25,960. Would you tell us what stage you have reached in that production now?—I have had six horses here from the beginning of November, and I have tried now the serum of five horses.

25,961. How long did you continue the process of immunization from the beginning of November?—Till the end of January, three months.

25,962. What was the maximum quantity of virus which you were able to give these horses ultimately?—I inoculated the horses five or six times, injecting a different quantity each time.

25,963. A larger quanity?—Not very large.

25,964. Was the second quantity larger than the first, and the third larger than the second, and so on?—Yes, always increasing the dose. The biggest dose I injected was two grammes and a half.

25,965. Of what?—Of the substance which we inject into the horses in order to immunise them.

25,966. What was that substance?—A nucleo-proteid, extracted from the microbes of plague, following the method I have described to the Commission.

25,967. A concentrated toxine?—Yes, a pure toxine.

25,968. Free from anything living, therefore without any living organisms?—Without any living microbes.

25,969. Have you any idea what is the quantity of it which is required to kill a horse?—One of my horses died a few hours after the immunising injection of 49 centigrammes.

25,970. That is a great deal more than the smallest quantity required to produce death?—Yes.

25,971. What was the largest quantity of this fluid which you ultimately injected?—I could not inject more than two grammes and a half because the horses suffer very much from this injection.

25,972. Two grammes and a half produced all the initial symptoms of the first injection with the smallest amount?—Yes, very big swelling, very big œdema in the place of the injection, and afterwards a high fever in the horse, and for some time after, the place of the injection has formed a centre of large exudation.

25,973. The local effects were very pronounced?—Yes, and sometimes there was necrosis of the skin of the horse.

25,974. Was there anything further, any other general symptoms?—The animal does not take its food, and it is very weak.

25,975. Did it lose weight or not?—Yes, it lost weight very much.

25,976. Have you tested this substance against the living organism as well as against the toxine?—No, it has no effect on the living bacteria.

25,977. What effect has the serum obtained from the horse?—The serum of the horse has bactericidal

power, and the microbes are agglutinated by the serum, and they died in a short time.

25,978. Is it very actively bactericidal?—Yes, it has very great bactericidal power.

25,979. What is its anti-toxic power?—The anti-toxic power does not seem to be very great.

25,980. It is mainly a bactericidal serum?—Yes, mainly bactericidal.

25,981. Have you made any observations on human beings, plague cases, with this serum?—Yes, the serum has been used at the Arthur Road Hospital—the Municipal Hospital—by Dr. Choksy.

25,982. In how many cases?—I think now we have treated 120 cases, only I have not heard a report of all these treated cases. This report has been made, however, and has been forwarded to the Government, and I shall send you a copy in a few days.*

25,983. Can you give us the general results?—I can tell you generally the results. In the beginning the type of the disease was very serious, and, especially, there were very many pneumonia forms, and almost in every patient there was complication of the lungs, localisation of the infection in the lungs, and the first results were not very satisfactory, but now, with the serum of the horse No. 4, the results are much better.

25,984. Is that a horse which has been carried further in immunization than the other horses?—No, almost all the horses were treated in the same way, but the serum of the horse which had been used lately has given much better results, and especially for the general clinical observation of the patients.

25,985. Was the nucleo-proteid used in the first inoculation the same as in No. 4 horse?—Yes, horse No. 4 was immunised in the same way, in the same order.

25,986. With the same nucleo-proteid?—Yes, and the same result in the symptoms of the disease, especially the temperature and the action of the pulse and the action of the heart. I remember that this serum has been injected into 47 patients, and 22 of them died, but I think that almost all the remaining patients will recover. The cases treated with this serum were almost all very bad, and some of them had also a complication of the lung, and I observed the microbes in the sputum.

25,987. That is a much more favourable result than with the other experiments?—Yes.

25,988. You did altogether 120?—Yes, I do not know the exact number, but you will get that information.

25,989. There are, therefore, about 70 other patients who were treated with serum, were there not?—Yes.

25,990. But that serum, you think, was not a good serum?—I do not think that the serum was much weaker than that of the No. 4 horse, but I think the patients were much worse.

25,991. These were not such bad cases?—They were all very serious cases.

25,992. The previous cases were very serious; these last were not so serious?—These were a little milder, not very mild, because mild cases are now very rare.

25,993. While these 47 cases were being treated there were other cases in the same hospital which were not being treated?—Yes.

25,994. What was the mortality of the other cases, and what was the number of the other cases?—The mortality would be about 85 per cent., or, perhaps, more.

25,995. It was a very strong contrast, therefore, this mortality with the mortality in your cases treated with serum?—Yes, very different.

25,996. What was the dose employed? How much did you use in the 47 cases?—The doses injected were from 60 to 120 c.c.

25,997. Was that the total quantity or the dose?—The total quantity.

25,998. In what doses?—15 or 20 c.c. for every dose.

25,999. Within what intervals of time were they given?—Sometimes the injection was done twice every day.

26,000. How many hours was the second injection after the first?—For example, if the first injection has been done in the morning, the second would be done in the afternoon or in the evening, and the third in the morning of the day after. The following injections depended upon the conditions of the patients; when the patient was better, the injections were suspended. If there was an increase of the temperature, or if the patient was getting weak in any way, the injections were repeated once or twice every day.

26,001. Are these differences about the same as in the previous 70 cases?—Yes.

26,002. And the average total given to one patient was about the same?—Almost the same for every patient.

26,003. Therefore, the explanation of the more favourable results in the second series is, that the cases were not quite so bad?—Yes; I think it is partly due to the fact that the cases are not so fatal as in the first series, and that the serum of the fourth horse has been proved more active on animals.

26,004. Have you made any experiments on the lower animals?—Yes, on monkeys.

26,005. (*Dr. Ruffer.*) I suppose you base your serum treatment on man upon your experiments on animals?—Yes.

26,006. So that if the serum were found to be useless in animals, you would not feel justified in trying it on man?—It would depend on circumstances.

26,007. What experiments have you made upon the animals with the serum of horse No. 4?—I have tried it on three monkeys.

26,008. What kind of monkeys?—Brown monkeys. I had four monkeys, one being used as a control. I injected the monkeys with 2 c.c. of the plague culture, which was very virulent. Three hours after the injection I injected the serum upon three of those monkeys 5 c.c. to each monkey. After 24 hours I injected another 5 c.c. of the same serum.

26,009. That is 10 c.c. altogether?—Yes. Two of the injected monkeys recovered.

26,010. Were they ill at any time?—I did not take the temperature, but they refused food on the first day. After that they began to eat again, and they recovered completely. One died after six days of plague, and I found the bacillus in the bubo. The control died in five days.

26,011. Will you give us the other experiments you have made on animals?—Yes; I put in the following statements with regard to them.

* *See* App, No. LXII. in this Volume.

EXPERIMENTS with the SERUM of HORSE No. 3.

Animals.	Weight.	Infection made on the 7th February.	Curative Injections.	Results.
White rat, 1st.	100	Piercing the tail with an infected needle.	After 3 hours, $\frac{1}{4}$ c.c. After 27 hours, $\frac{1}{2}$ c.c.	Cured.
White rat, 2nd	—	Ditto	After 3 hours, $\frac{1}{4}$ c.c. After 27 hours, $\frac{1}{4}$ c.c.	Cured.
White rat, 3rd	—	Ditto	After 7 hours, $\frac{1}{4}$ c.c.	Dead on the 10th February
White rat, *control*	—	Ditto	—	Dead on the 8th February.
Monkey A.	4 lbs.	Injection of 2 c.c. culture	After 5 hours, 5 c.c. After 24 hours, 5 c.c.	Cured.
Monkey B.	4 lbs.	Ditto	After 5 hours, 5 c.c. After 24 hours, 5 c.c.	Cured.
Monkey, *control*	4½ lbs.	Ditto	—	Dead on the 12th February.

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EXPERIMENTS with the SERUM of HORSE No. 5.

Animals.	Weight.	Infecting Injections.	Curative Injections.	Results.
White rat, 1st	120	$\frac{1}{4}$ c.c.	After 3 hours, $\frac{1}{2}$ c.c. After 27 hours, $\frac{1}{4}$ c.c.	Cured.
White rat, 2nd	100	$\frac{1}{4}$ c.c.	After 3 hours, $\frac{1}{2}$ c.c. After 27 hours, $\frac{1}{4}$ c.c.	Cured.
White rat, *control*	110	$\frac{1}{4}$ c.c.	——	Dead on the 13th January.
Monkey 1	4 lbs.	2 c.c.	After 3 hours, 5 c.c. After 27 hours, 5 c.c.	Cured.
Monkey 2	5 lbs.	3 c.c.	After 3 hours, 5 c.c. After 24 hours, 5 c.c.	Dead on the 18th January.
Monkey, *control*	4 lbs.	2 c.c.	——	Dead on the 16th January.

The animals were all injected on the morning of the 12th January, with an emulsion of an agar culture of 48 h.

EXPERIMENTS with the SERUM of No. 1 HORSE.

Animals.	Weight.	Infection made on the 20th February.	Curative Injections.	Results.
White rat	—	Injection of $\frac{1}{2}$ c.c. under the skin.	After 3 hours, $\frac{1}{2}$ c.c. After 24 hours, $\frac{1}{2}$ c.c.	Cured.
White rat, *control*	—	Ditto	——	Dead on the 21st February.
Monkey C.	5 lbs.	2 c.c. of culture	After 3 hours, 5 c.c. After 24 hours, 5 c.c.	Cured.
Monkey D.	4 lbs.	Ditto	After 3 hours, 5 c.c. After 24 hours, 5 c.c.	Dead on the 28th February.
Monkey, *control*	4 lbs.	Ditto	——	Dead on the 25th February.

EXPERIMENTS with the SERUM of No. 4 HORSE.

Animals.	Weight.	Infection made on the 25th February.	Curative Injections.	Results.
Monkey, *control*	4½ lbs.	1 c.c. of culture	——	Dead on the 2nd March.
Monkey E.	5 lbs.	1 c.c. of culture	After 5 hours, 5 c.c. After 27 hours, 5 c.c.	Dead on the 3rd March.
Monkey F.	4 lbs.	1 c.c. of culture	After 5 hours, 5 c.c. After 27 hours, 5 c.c.	Cured.
Monkey G.	5 lbs.	1 c.c. of culture	After 5 hours, 5 c.c. After 27 hours, 5 c.c.	Cured.

26,012. Did you find that all brown monkeys which you injected with plague died, or that a certain number of them recovered?—The brown monkeys are not very susceptible to plague, and it is necessary to have a very virulent culture in order to communicate plague to them—a culture which has been passed through many animals.

26,013. Do you consider that a culture which takes four days to kill a monkey is very virulent?—Yes, it is very virulent.

26,014. Have you ever found a culture which killed a monkey after two days or 36 hours?—Yes, by injecting large quantities.

26,015. It is not the most virulent culture you can get, is it?—Yes; it was the most virulent I could get which I used for these experiments.

26,016. Were these experiments with the serum of horse No. 4, in which you treated 47 patients and had 22 deaths, carried out by Dr. Choksy?—Yes.

26,017. In the hospital?—Yes.

26,018. Can you tell me how many patients, on an average, come into the hospital in a moribund condition?—I think more than half the patients that are admitted.

26,019. How many come in a hopeless condition?—More than half of the patients.

26,020. So that you cannot contrast the mortality of 85 per cent. with your mortality of 22 per cent.?—I do not contrast them.

26,021. Were these 47 patients all patients whom you thought had a chance of recovery?—Some of them were injected when they were in a hopeless condition.

26,022. How many?—I cannot say.

26,023. Did you exclude all moribund cases, and all cases which you thought were bound to die?—Yes.

26,024. Did you exclude all pneumonic cases?—Yes, but sometimes pneumonia is not recognised.

26,025. Did you exclude all cases which you knew had pneumonia?—Yes, all those who had very evident pneumonia.

26,026. Some of them had secondary pneumonia?—Yes; sometimes they were injected patients who were believed by Dr. Choksy at the beginning not to have pneumonia, but who afterwards developed pneumonia.

26,027. Did you exclude all septicæmic cases?—No, because we did not examine the blood before the injections.

26,028. You say that injection had an effect on the pulse; how long after the injection did you notice that effect on the pulse?—Four or five hours.

26,029. Do you think that might not have been due to the patients resting in bed?—No, because such improvement was not observed in the patients not treated with the serum. There is also an effect on the delirium.

26,030. What is the effect on the delirium?—Sometimes the delirium subsides after the injection.

26,031. In how many cases did you find that it subsided?—In almost all the patients which recovered.

26,032. On what day did the delirium subside?—In two or three days after the injection.

26,033. It had not an immediate effect on the delirium?—Sometimes it had, but not generally.

26,034. Had it an immediate effect on the lung symptoms?—No.

26,035. How many of these patients had microbes in the sputum?—I should think two-thirds.

26,036. In the cases which you treated which had lung symptoms, how many recovered?—I cannot say.

26,037. (*Professor Wright.*) What is your evidence for the statement that your serum possesses any bactericidal power?—I have done experiments in vitro.

26,038. What did these experiments consist of?—I mixed the serum with the plague culture in bouillon.

26,039. Did you ever find by that method that all the plague bacilli were killed?—There was a decrease in the number of the colony, developed on Petri's dishes inoculated with the culture mixed with serum. After about 24 hours there generally is no more development of microbes.

26,040. With what serum did you make these experiments?—With the serum sent me from Florence.

26,041. Have you made the same experiments with the serum you have now?—I have just begun these experiments.

26,042. Did you determine whether the serum which you gave to the Commission possessed any bactericidal power?—The experiments on the subject are not yet completed. I have examined the action of the serum on the microbes under the microscope.

26,043. You saw agglutination under the microscope?—Yes.

26,044. With the serum?—Yes; I tested it several times.

26,045. Did you find that you got satisfactory agglutination with serum No. 1?—I tried No. 3 and No. 4.

26,046. Did you get satisfactory agglutination with serum No. 3?—Yes; there was always agglutination.

26,047. How much did you dilute the serum?—I only put a few drops of the serum in the bouillon culture.

26,048. Have you done any experiments on animals with the serum with which you have provided the Commission?—Yes.

26,049. With which serum?—The serum from horse No. 1 and horse No. 3.

26,050. Have you tried any experiments on man with the serum?—Yes.

26,051. With a portion of the serum with which you have provided us?—Yes. With serum No. 3, I injected 17 patients, of whom 10 died and 7 recovered.

26,052. What were your results with serum No. 1?—I do not remember because that was done by Dr. Choksy.

26,053. Did Dr. Choksy also try serum No. 3?—It was tried in the hospital.

26,054. Can Dr. Choksy provide us with the notes of the cases which were injected with sera Nos. 1 and 3?—Yes.*

26,055. Cases injected with the same serum with which you provided us?—Yes.

26,056. What experiments did you make in order to determine whether the serum possessed any anti-toxic power?—I have made no experiments in that direction in Bombay.

26,057. Have you ever found that serum No. 1 or No. 3 made the animals die sooner than the controls?—No.

26,058. Have you never seen that occur with any of the sera which you produce?—I have seen it in small white mice. At the beginning I tried to do the experiments for testing the serum on white mice, but they cannot shake off the shock of the injection and they die within a short time after the injection. I tried to inject them also with a physiological solution or with bouillon, and they died in the same way.

* *See* App. No. LXII. in this Volume.

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26,059. Do you think a horse which is itself suffering in health, that is, which has not recovered from the injection, can provide a serum capable of benefiting a plague patient?—I never tried to bleed a horse when it had still fever, so I cannot say. I have always bled a horse after the fever had gone.

26,060. But I understand you bleed your horses before they have recovered their original state of health; is that so?—When I bleed the horses they are in good condition, they have no fever, and they take their food properly.

26,061. Do you think a horse which has not yet recovered from the effects of inoculation can give a good serum?—I cannot say that.

26,062. If you found that the animals which received the serum died before your controls would you still proceed to do experiments on man with that serum?—I should repeat the experiments on different animals.

26,063. But if you tried it two or three times on different animals?—I do not think that the serum can do any harm to the patient. I think if one serum is not effective it can be completely harmless.

26,064. But if you saw the animals which received the serum dying sooner than the control animal, would you not think that the serum did the animals harm?—Yes; if I were sure to have eliminated every cause of errors in the experiments.

26,065. If you had a serum which you knew would do animals harm, would you give that serum to man?—It depends upon the conditions of the experiment.

26,066. Would you yourself take such a serum?—If the animals were really killed by the serum I certainly would not inject it into a patient.

26,067. And if the animals which were injected with the serum died quicker than the controls, you would not advise anybody else to give that serum to man for curative purposes, would you?—It depends upon various considerations.

26,068. Therefore, I ask you if you would take the serum yourself if you found it killed animals?—No, I would not take a serum proved poisonous.

26,069. *(The President.)* Have you had any opportunity of trying any anti-toxic serum, not only plague, but any other anti-toxic serum, possessing more poisonous qualities than a normal serum?—No, I have not.

26,070. You do not know that it is the case that some anti-toxic sera are more poisonous than others?—No.

26,071. Supposing it had come to your knowledge that anti-toxic sera are capable of producing poisonous symptoms as a rule, that is, that the tetanus anti-toxine or dyphtheria anti-toxine, as a rule, are more poisonous than normal sera, would that deter you from using the plague anti-toxine in the treatment of plague?—I would not use it. If these toxic properties were proved, I would not use it.

26,072. Suppose they are in existence in the anti-tetanus serum, would that deter you from using it in the treatment of tetanus?—It depends upon the gravity of the toxic properties.

26,073. Have you ever tested the toxic power of this plague serum which you have been working with? Have you administered it alone to any of the lower animals?—No, I have not.

(Witness withdrew.)

Mr. C. C. JAMES called and examined.

Mr. C. C. James.

26,074. *(Dr. Ruffer.)* You are one of the Engineers to the Bombay Municipality?—Yes, Drainage Engineer for the City.

26,075. What experience of plague have you had?—I was first of all on plague duty under the Municipal Commissioner from September 1896 to March 1897, and then I was on the Plague Committee from March 1897 to May 1898, when I went on leave.

26,076. You put in Chart No. 1, showing the mortality from all causes which occurred in Bombay from August 1st, 1896, to March 15th, 1899?—Yes.*

* *See* App. No. LXXVII. in this Volume. The chart was subsequently continued to the end of May, 1899.

26,077. Will you kindly describe the chart?—The two upper black lines are the maximum and minimum temperatures. The thin blue line is the population.

26,078. Could you tell us how the maximum and minimum temperatures were ascertained?—They were obtained from the Observatory at Kolaba.

26,079. How was the number of the population obtained?—That was obtained from the Bombay tramway statistics, checked with the Government returns supplied by the Collector of Bombay.

26,080. What do you mean by saying they were checked by the Government returns?—The population is assumed at the start to be 850,000, which is obtained

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in the following way:—The Census for 1891 gave 821,000 for the city. That gave us an increase of so many thousands on the previous census, and carrying that calculation forward we got a population in August 1896 of 850,000. That is carried forward, and the tramway people, taking that as correct, have worked out on their receipts a rule for population, and we check their numbers for population with the returns which the Collector of Bombay gives us every month. We find that it comes within 10,000 or 12,000—quite near enough for this purpose.

26,081. Do all classes of people use tramways?—I think practically only the working classes.

26,082. But do the lowest classes use tramways?—I think not, not to a great extent.

26,083. Then, how can the tramway statistics be correct; would the lowest and very poor classes leave the town?—There is a very large moving population here.

26,084. But you base your total population on the tramway statistics. Now, supposing a large number of people emigrated from Bombay, surely they would be mostly people who would use tramways, the higher workmen and the lowest middle-class people. Would they not leave in larger proportion than the coolies?—No, I do not think so.

26,085. Would the coolies leave in as large a proportion?—I think so.

26,086. What evidence have you of that?—I have not any evidence. That is the best information we can give you with regard to population.

26,087. It is only approximate?—Yes.

26,088. Within what number is it approximate?—Within 10,000 or 15,000. We know what people leave the city, and what people come in, because we get the returns from the railways, the steamer companies, and of the roads; in fact, the people leaving by every exit from Bombay are counted. These returns cannot be very far out.

26,089. Why do you take the tramway statistics instead of taking the figures of people leaving and coming to the city?—We take both; but the tramway company were the first to publish returns of population, and as they were found to be nearly correct we accepted them. I think that the figure given this year is slightly in excess of the actual, owing to so many persons having sent their wives and children out of Bombay.

26,090. Are the figures you give here the tramway figures?—Yes, checked with those returns.

26,091. The figures actually entered on the chart are the tramway figures?—Yes.

26,092. Will you continue your explanation of the chart?—The green line shown here is the humidity. The thick red line is the daily mortality, and the thin red line is the normal mortality based on an average of five years previous to 1896. The purple line is the velocity of the wind, and the brown line is the clouds.

26,093. Do you think there is any relation between either the maximum or minimum temperature and the mortality in Bombay?—It is difficult to form any real opinion from the chart. The chart is very contradictory. I cannot say there is any very great relation between them.

26,094. Is not the mortality greater during the winter months?—Yes.

26,095. Is it the largest in the same months in the three preceding years?—Yes.

26,096. Is not the mortality much larger now than it was in February 1897?—Yes, it is. The number of deaths is greater.

26,097. When was the highest mortality in 1896–97?—On the 14th January.

26,098. In 1897–98 it was in February, I think?—Yes.

26,099. And in 1898–99 in March?—Yes.

26,100. Do you think the population is larger now than it was in 1896–97?—Yes.

26,101. If you calculate the mortality according to the population, do you find the mortality this year is smaller than it was in the preceding years?—Yes; I put in Chart No. 2,* which shows the epidemics for three seasons, 1896–97, 1897–98, and 1898–99, with the weekly death-rate plotted per mille per annum.

26,102. So that the conclusion is that, although at first sight the mortality appears to be higher this year, it is actually lower in proportion to the population?—Yes.

26,103. Did you find any relation between humidity and plague?—Yes. Northerly and easterly winds, which are always dry, seemed generally to have an unfavourable influence, often immediately so, on the mortality.

26,104. To what you attribute that? Do you think it is possible that northerly and easterly winds, being cold, drive people into their houses?—Yes, undoubtedly. The result of that is that, instead of a large number of people sleeping out of doors, as is generally the case during the hot weather, they all sleep indoors, and moreover they shut their doors and windows. It is calculated that 350,000 people sleep in the streets here during the hot season.

26,105. Were there any special meteorological conditions just before the advent of plague?—Yes, in 1896 they were very interesting. The mean annual temperature for 1896 was 80·07, being the highest but one on record for the last 50 years. The total fall of rain for the year was 87·65 inches, which again is abnormal, being nearly 15 inches above the average of the last 50 years. These facts in themselves would, without further explanation, mean little, but it is necessary to consider the details of this fall of rain. June gave us 28 inches, being 8 inches above the average, July was 36·44 inches, being 11·7 inches above the average, August gave us 20·8 inches, being 7·5 inches above the average, and after the end of August only 1·61 inches of rain was registered, being 10 inches less than the average.

26,106. Have these same conditions prevailed in 1898–99?—No.

26,107. So that they would not explain the continuance of the plague in those years?—No.

26,108. Is there any relation between the height of the subsoil, water and plague?—There is no doubt that high subsoil water predisposes to disease; I think in that way there is a connection. There is an interesting point in Chart No. 1, I would mention, and it is the deaths from plague from August 1896 to end of June, 1897; 46,886 people died from plague. The average number of deaths for this period, calculated on five years previously, is 18,289, and the difference, 27,597, must be taken as plague. From July 1st, 1897, to May 1st, 1898, the deaths from all causes was 50,150, and the number on the average of five previous years was 24,192, and the difference—plague—25,958. From May 1st, 1898, to 20th March, 1899, the total deaths from all causes was 44,362, while the average is 25,759, and the difference, 18,503, is plague. This gives, for the first epidemic, 27,597 deaths from plague, the second 25,958, and the the third, to March 20th, 18,503 total, 72,058.

26,109. You have some other charts which you wish to put in?—Yes, the three plans of Bombay,* showing the progress of plague.

26,110. Will you kindly explain them?—These three plans represent the three epidemics. The seven primary colours have been taken there to represent months. When a case occurs in a district, unless the district is epidemic, it is shown by a coloured circle, appertaining to the month. For instance, take Byculla; in September 1896, as will be seen from the pink circle, there were 3 deaths from plague, in October 9, in November 2, and then in December the whole district became epidemic, having 112 deaths recorded as shown in the margin of the plan; in January 205 deaths occurred, in February 318, and in March 177. After the epidemic is over, the deaths are shown in a scored and coloured circle, showing that in April there were 50 deaths, in May 15, in June 6, in July 5, and in August 2. All the districts are worked in that way, so that it is possible to tell where each district has become epidemic. For instance, all these districts (Walkeshwar, Worli, Mahim, Sion, Parel Sewri) were epidemic in January. Mandvi was epidemic in October, so that you see the course of the disease, which is from south to north. That is probably because the people fled from Mandvi and that part of the city to the outlying districts. Then this plan also

* *See* App. No. LXXVIII. in this Volume.

* Not reprinted with the Proceedings of the Commission.

shows that the whole of the island was epidemic in 1896-97, except one district, namely, the Esplanade. Those districts which escaped being epidemic last year were Esplanade, Upper Kolaba, Walkeshwar, Mahalakshmi, Sewri, and Sion. These districts have also remained practically free in the third epidemic. Sion is a large district with several small villages, and those villages in proportion to their population have suffered much more than the population of the districts in the middle of the city. The last plan, viz., for 1898-99, is very interesting, because it shows a small district called Chuckla, a crowded Muhammadan part of the city, which has only had 68 deaths recorded in this epidemic; it is densely populated. Whether that is accidental or whether the deaths have not been registered it is impossible to say. I cannot account for it. Then Mahim, for instance, is very badly affected; it is a very low-lying district, full of water; no sun gets there.

26,111. *(Mr. Cumine.)* Is it worse now than it was?—Mahim is very bad just now. I think this plan also shows a further improvement again in the number of districts which are not epidemic:—Sion, Worli, Walkeshwar, Mahalakshmi, Chowpati, Esplanade, Upper Kolaba, and Chuckla, eight against seven last year. I think there is some connexion between plague and a high sub-soil level, from the fact that in nearly all the low-lying districts where the sub-soil water is high, plague has been scarcely ever absent during the last three years.

26,112. Has the plague got out of Mandvi now?—There is not much plague there at present, it is rather a recrudescence than anything else. *Mr. C. C. James.* 20 Mar. 1899.

26,113. *(Dr. Ruffer.)* Are the low-lying districts the most thickly populated districts?—Very often they are.

26,114. So that the larger mortality may be due either to overcrowding or to the fact of the districts lying low?—Yes.

26,115. Is there anything else you wish to add?—I have four other plans with me which show the actual houses infected in the districts.

26,116. I do not think we shall require those?—I should like to say that one of the most interesting things in Chart No. 2 is that both the previous epidemics stopped about the same time. If the third one is going to stop as the previous ones have, and as it appears to be going to do it, this would rather point to the fact that next year the epidemic will start later than it has done this year and finish again at the same time, and the following year follow the same course until the lines meet. You will see that the two lines cross one another at the end of April.

26,117. *(The President.)* Would it be possible to get the charts kept up to date?—Yes, I will endeavour to do so. (NOTE.—Witness supplied the Commission with additions to the charts, to bring them up to the end of May 1899, as shown in App. No. LXXVII. and App. No. LXXVIII. in this Volume.)

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

SIXTY-NINTH DAY.

Tuesday, 21st March 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. *(President).*

Mr. J. P. HEWETT.
Prof. A. E. WRIGHT, M.D.
Mr. A. CUMINE.
Dr. M. A. RUFFER.

Mr. C. J. HALLIFAX *(Secretary).*

Capt. C. G. SPENCER, R.A.M.C., called and examined.

26,118. *(The President.)* I believe you are in the Royal Army Medical Corps?—Yes. *Capt. C. G. Spencer, R.A.M.C.* 21 Mar. 1899.

26,119. And I think you have been engaged for some time on special work in connection with the plague bacillus?—Yes.

26,120. What previous opportunities have you had for engaging in bacteriological investigation?—I have done bacteriological work at Netley, but since then I have not done any bacteriological work.

26,121. How long ago was that?—That was five-and-a-half years ago.

26,122. In the work which you have just been doing I believe you have arrived at certain conclusions with regard to the recognition of the plague bacillus, have you not?—Yes.

26,123. Will you kindly tell us what conclusions you have arrived at?—The plague bacillus in the blood and tissues of an animal can be recognised, as a rule, with some certainty. Its characters are constant and distinctive. In a pure culture the characters of the bacillus are not at all so constant. They differ from the appearances seen in animals, and it is much more variable in a pure culture.

26,124. The bacillus as obtained from an animal affected by plague has a different appearance from a bacillus grown in a culture?—Yes.

26,125. What are the differences?—The bacillus in cultures is smaller; its shape is different; the size is more variable; involution forms are more numerous; and the bi-polar staining—one of the most constant appearances in blood—is very much less marked in the culture.

26,126. The bacillus culture is the more virulent?—I cannot say whether it is more virulent.

26,127. You do not consider the microscopic diagnosis is sufficiently conclusive?—No; I would never rely upon microscopic appearances alone.

26,128. What would you take in combination with microscopical appearances, to make yourself quite certain?—Experiments on animals, the appearance of the bacillus in pure culture, the mode of growth, and the rate of growth.

26,129. Have you found anything worthy of note with regard to the growth of the plague bacillus by Hankin's method?—Yes. I made two series of experiments with Hankin's reducing solution.* In each case I took five

* *Vide* Question, No. 8604. The solution referred to consists of:—

Ferrous sulphate	10 parts.
Tartaric acid	10 parts.
Citric acid	1 part.
Water	100 parts.

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tubes of broth and added from one to five drops of Hankin's solution, and then added the pure culture of plague to the broth. These tubes were kept at the temperature of the room and examined at various intervals for a week. Decolorisation was very slightly marked, and occurred in only one or two of the tubes. I did not recover the plague bacillus from any of the tubes.

26,130. What is your opinion with regard to the method?—It does not seem to be a reliable method for detecting the plague bacillus.

26,131. I believe you have observed the growth of plague in earth also?—Yes.

26,132. Will you state the result?—The method was as follows. Twelve small glass tubes, each pierced with a lateral hole were taken, and these were filled with earth. The earth was obtained from Calcutta, and was not supposed to be infected. They were plugged with cotton wool, and sterilised. The lateral hole of the tube was guarded with a tight-fitting india-rubber band. The earth in six tubes was saturated with sterile water, and the six other tubes were kept dry. All were inoculated with one drop of a fresh plague culture dropped on the surface. The tubes were kept at the ordinary temperature of the room in diffused light. After four days they were examined and no plague bacillus could be recovered, either from the surface of the tubes or at different depths below the surface from one-sixteenth of an inch to one inch.

26,133. By what process could that not be recovered, by microscopical examination, or what?—By attempting to grow it in broth.

26,134. Have you examined any samples of earth which you knew probably contained plague, or were obtained from places where the earth might contain plague?—Not by direct microscopic examination.

26,135. You have done it by other methods?—Yes.

26,136. What methods?—By making agar plate cultures, by Hankin's method, by cultivating in carbonic acid, and by inoculating animals.

26,137. What was the result of the agar plate cultures?—Seven specimens of earth from the floors of plague-infected houses were examined by agar plates, and the plague bacillus was not found at all. Four different bacilli, which could not be distinguished from plague by the microscope, were found. These were proved not to be plague by their method of growth. Three of them were chromogenic, and only when observed a little longer formed spores.

26,138. Were inoculation experiments made with them?—Not with them.

26,139. What was the result of your trials with Hankin's method?—Ten specimens of earth from plague-infected floors, and one specimen of dust from an infected pucka floor, were examined by mixing the earth with sterile broth and inoculating the emulsion into a series of five broth tubes containing from one to five drops of Hankin's solution. In none of these were plague bacilli found. Bacilli resembling plague in microscopical appearance were found in four of these specimens. These were tested by inoculations on animals, and we came to the conclusion that they were not plague.

26,140. You mean there was no pathogenic power?—No.

26,141. With regard to the carbonic acid method, what is that?—I examined seven specimens of earth from plague-infected floors by the carbonic acid method, and from two specimens bacilli closely resembling plague were obtained; but whether they were plague or not I cannot say, as my experiments are not completed.

26,142. Have you done anything further; have you taken other steps for identification, and inoculated animals?—I have inoculated animals.

26,143. What has been the result?—One animal inoculated with one of these bacilli died within 12 hours; but by the time it was found it was so far decomposed it was impossible to draw any conclusion from the examination. In the other case the animals were inoculated three days ago, and they are still living. Those experiments I shall repeat.

26,144. So that you are not in a position to say anything definite about that?—No. I have also examined three specimens of unsterilised garden soil to which small quantities of a plague culture had been added. From two of these three specimens I have recovered the plague bacillus.

26,145. Could you give us the details?—A small quantity of unsterilised garden soil was added to sterile broth and a pure culture of plague bacillus was added to the mixture of earth and broth. Carbonic acid gas was passed through. The tubes were sealed and incubated for from four to seven days and examined at different intervals. On examining these cultures microscopically I did not see anything resembling plague; but on making agar stroke cultures, from two of the specimens bacilli were isolated, which resembled plague microscopically. They grew rather faster than plague on agar. On inoculating animals, the animals died, and plague bacilli were found in the blood.

26,146. What were the pathological appearances in these animals?—They were inoculated intraperitoneally. One of them had buboes.

26,147. Where?—The buboes were in both groins. The liver and spleen were congested and dark.

26,148. Only one had buboes?—Yes, only one had buboes.

26,149. But in both cases you recovered a bacillus from the blood which very closely resembled the plague bacillus?—Yes.

26,150. Have you made any experiments as to the effect of saprophytic organisms on the growth of the plague bacillus?—Yes. The object of these experiments was to ascertain if any saprophytic organism could be found which influenced the growth of the plague bacillus either favourably or unfavourably. The method employed was to obtain a pure growth upon broth of the organism under examination, to filter the broth culture through porcelain, then to pour some of the filtrate on to the surface of a sloped agar tube, allow it to soak into the agar for a few minutes, and then pour it off again. Plague bacilli were then planted on the agar tube thus treated, and also on an untreated agar tube to serve as a control. The tubes were kept at the temperature of the room, and the amount, character, and rate of growth were compared from day to day, and any differences noted; 22 different organisms were isolated. These were all obtained from the floors of plague-infected houses. Of these 22 organisms 15 were bacilli, of which seven were spore-bearing, and five were chromogenic; six were cocci, three of which were chromogenic, and one was a sarcina; 15 of these organisms were tested by the above method as to their effects on the growth of the plague bacillus. In no case was any definite effect, favourable or unfavourable, on the growth of the plague bacillus detected. Bacillus coli communis was also tested by the same method. The growth of the plague bacillus in the tube treated with the filtrate of a broth culture of bacillus coli was at first decidedly retarded, but after five or six days it grew better, and by the tenth day there was little difference between the growth in this tube and that in the control tube. The experiment was also tried of growing the plague bacillus in the filtrate from a broth culture of bacillus coli. It grew slowly at a temperature of 37° C.; and sub-culture from this tube made on agar and kept at the temperature of the room grew, but very slowly at first. As tested by these methods the effect of bacillus coli on the growth of the plague bacillus is not very powerful.

26,151. Are there any other points you would like to bring before us?—Yes. I have tried the direct inoculation of animals with earth from plague-infected floors.

26,152. Perhaps you will give us information about that?—One specimen of dust from a pucka floor, and eight of earth from plague-infected floors were mixed with sterile broth, and the emulsion injected under the skin of rats.

26,153. Were the floors infected?—The earth I used was collected in sterile test tubes from floors of plague-infected rooms. As soon as I received information that a case or a death from plague had occurred, I went myself and collected the earth, in some cases before the body had been removed, and in every case before disinfection.

26,154. What parts of the floor did you take your specimens from?—As far as I could ascertain from close beside where the patient had been lying.

26,155. How many specimens did you take?—18.

26,156. Did you take specimens from only one part of the floor?—In some cases from different parts, and in other cases from one part.

26,157. What was the maximum number of parts?—Two. Of the nine rats inoculated six survived and had no symptoms; three died, two on the third day, and one on the sixth day. The *post mortem* appearances were not those of plague, and no plague bacilli were found in the blood or organs, or at the sites of inoculation.

26,158. What conclusion do you draw from that series of experiments?—I have come to the conclusion that that method is not a satisfactory one for discovering plague in infected floors. I may mention that two specimens were also inoculated into rabbits. One of the two rabbits survived, and had no symptoms. The other died on the ninth day. No plague bacilli were found in the body.

26,159. Is there any other matter you wish to bring before the Commission?—Yes. In addition to the above experiments, a specimen of water and another of mud from a pond behind the Mahratta Plague Hospital were examined. Waste water from a ward had been allowed to run into this pond, and the clothing of some patients had been washed in it. Several cases of plague had occurred among people using the pond water. Two c.c. of water injected into a rat killed it in three days. No plague bacilli were found in the body. By Hankin's method a bacillus microscopically resembling plague was found in the water. This was injected into a rat, which died in five hours, but no organisms of any kind were found in the body. This bacillus was not isolated in pure culture.

26,160. What was the pathological condition of the dead body?—There were no plague bacilli found in the body. I cannot state the exact pathological appearances.

26,161. Can you say whether there were or were not buboes?—There were no buboes. The mud from the pond was mixed with broth and injected into the rat, which died in three days. No plague bacilli were found in the body. Hankin's method gave negative results.

26,162. Was the quantity injected into these animals large or small?—The quantity of water injected was 2 c.c. In the other case 1 c.c. of broth in which a small quantity of mud had been shaken up was injected.

26,163. Therefore it was rather dilute?—No, not very dilute.

26,164. It would depend upon how much broth you mixed?—It was a pretty thick emulsion of mud and broth.

26,165. (*Dr. Ruffer.*) You said you made some microscopical examination of earth. I do not think you gave us the results?—Six specimens of earth from Calcutta were examined microscopically. In four of these diplo-bacilli morphologically resembling plague were seen. In two the diplo-bacilli were exceedingly abundant, some occurring in every field of the microscope. Judging from other appearances these samples had been taken from the surface of the earth.

26,166. How can a plague patient infect the floor?—By sputum, and by the urine.

26,167. And possibly by the fæces?—Yes, possibly by the fæces.

26,168. What is the largest quantity of earth which you have examined, either by inoculation or by the plate method at each examination; would it amount to a gramme, or to a very small part of a gramme?—It would amount to several grammes in some instances. *Capt. C. G. Spencer, R.A.M.C.* 21 Mar. 1899.

26,169. How many grammes altogether?—I did not weigh it.

26,170. Roughly speaking, will it be 2 or 3 grammes?—Yes, quite.

26,171. So that the possibility of finding the plague bacillus in the earth will be extremely small?—Yes.

26,172. (*Prof. Wright.*) Have you come to the conclusion that the results obtained by the method of direct examination as to the presence or absence of plague in earth are likely to be fallacious?—I have formed the opinion that they are very likely to be fallacious.

26,173. With regard to your experiments of isolating plague by Mr. Hankin's solution, do you happen to know if Mr. Hankin attaches any importance to this method?—I believe he does not attach any importance to this method.

26,174. But in view of the fact that we have had evidence before us that plague has been detected by this method, you desire to record that, in your experience, the plague bacillus is generally killed off when it is treated by this method?—Yes.

26,175. So far it would be a very ineffective method of looking for the plague bacillus?—Yes.

26,176. Further, you have come to the conclusion that bacilli resembling the plague bacillus are able to survive in this fluid?—Yes.

26,177. It would therefore be a fallacious method?—Yes.

26,178. Therefore you would not lay any reliance on the method—as a method of detecting the presence of plague bacilli in fæces, for instance?—I should place no reliance on the method at all.

26,179. With regard to your methods of seeking for plague in earth, have you been more successful with the carbonic acid method than you had been with other methods?—It is the only method by which I have succeeded in isolating plague from earth.

26,180. Do you know how this method was suggested?—It was suggested by Dr. Marsh's experiments on the effect of burying plague cultures.

26,181. Would you describe accurately the carbonic acid method for detecting plague in earth; what method did you employ?—A small quantity of earth was added to a tube of broth and shaken up. Carbonic acid gas was passed through and the tube sealed, and incubated for from four to seven days.

26,182. Do you think there are high percentages of carbonic acid in the fluid?—Yes. I think it was saturated.

26,183. Do you think the atmosphere above was saturated?—Yes; I think the atmosphere above was saturated.

26,184. Has Dr. Marsh made any experiments upon the discovery of plague in earth by means of the carbonic acid method?—I do not know any details about his experiments.

(Witness withdrew.)

Lieut. STEWART R. DOUGLAS, I.M.S., called and examined. *Lieut. S. R. Douglas, I.M.S.*

26,185. (*The President.*) How long have you been engaged on special plague work?—Since the 17th of December 1898.

26,186. (*Dr. Ruffer.*) You have been making some experiments on the treatment of patients affected with plague, with Roux' serum, have you not?—Yes.

26,187. Can you tell us under what conditions these experiments were made?—Forty-nine cases were treated at Bangalore. Every case that came into the hospital was taken, except those that were obviously not plague, or those that were convalescent from plague—that is to say, people that had suppurating buboes.

26,188. You made no choice of the patients you inoculated and those you did not inoculate?—No.

26,189. Can you put in a table of cases with the notes of all these cases that you inoculated?—Yes.

26,190. Each case has the temperature chart, the pulse chart, and the respiration chart added to it?—Yes.

26,191. And each case gives the number of inoculations, the time of inoculation, and the quantity of fluid injected?—Yes, I hand in the tables.*

26,192. Can you tell us whether you have noticed any evil effects from Roux' serum?—I have never noticed any evil effects.

26,193. Did you ever have any joint pains after the inoculation of Roux' serum?—In one case, but I did not treat it myself.

* *See* Appendix No. LXXIX. in this Volume.

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26,194. Can you tell us whether you noticed any effect of Roux' serum either on the pulse, or the temperature, or the respiration?—Never a constant effect. No constant effect was noticed in any series of cases.

26,195. Can you tell us whether the effect of Roux' serum was to reduce the mortality in your cases?—At Bangalore I had to take the North Camp as a control against the South Camp. The previous mortality in the South Camp up to the date of my arrival had been 58·7 per cent. While I was there, there were 73 admissions—some of those were not plague, some were convalescents, and some died before I saw them. The percentage of deaths, during the time I was treating with Roux' serum, was 47·9 per cent. The bubonic cases that came in during that period were 39, and the number of deaths 20, giving a percentage of deaths of 51·3. The total cases treated with Roux' serum were 49, and the deaths were 31, giving a percentage of 63·26. Against that it must be said that I took all the serious cases, because the convalescents were not treated by Roux' serum.

26,196. What was the mortality in the North Camp before you came?—In the North Camp up to the 19th November—that was before I came—it was 75·13 per cent. Between the same dates as when I was treating cases in the South Camp, the percentage of deaths was 53·7. The total bubonic cases admitted during that time were 14, of whom 10 died, giving a percentage of 71·42.

26,197. So that the reduction in your mortality by Roux' serum was not greatly marked?—No, not greatly marked.

26,198. (*The President.*) What was the reduction?—We cannot tell exactly what the reduction was. The South Camp Hospital gave a better balance all along. During the time I was there, it was about 5 per cent. better in the South Camp than the North Camp.

26,199. That is, of those treated with Roux' serum?—No.

26,200. Then what about those that were treated with Roux' serum?—With regard to those treated with Roux' serum, I have no direct controls there.

26,201. You did not control the cases there?—No, not at Bangalore.

26,202. (*Dr. Ruffer.*) I think you made some experiments here with Roux' serum?—Yes.

26,203. Can you give us the result of them?—I treated 15 cases with 15 controls. They were taken as they came into the plague ward of the Modi Khana Hospital, and they were handed over to us, and we took every second one that came in,—Lieutenant Walton and myself. I treated 15, with 15 controls, and he treated 13, with 13 controls. Amongst my cases of those treated with Roux' serum, there were two recoveries; amongst the controls there were four recoveries.*

26,204. Was your experience on the whole here the same as your experience at Bangalore?—Yes.

26,205. You noticed no effect either on the pulse, or the respiration, or the temperature, or on the general condition of the patient?—No, none at all.

26,206. Nor on the delirium?—No, they seemed very much the same.

26,207. Is there anything else you would like to add about your experiments with Roux' serum?—Taking the whole of the cases treated by Dr. Walton and myself, there were 27 cases treated by Roux' serum, and 27 controls. Of those there were five recoveries in the Roux cases, and four recoveries in the controls. It works out to a percentage of 81·48 per cent. of deaths for the Roux cases, and 85·18 per cent. for the controls—practically the same.

26,208. Have you made any experiments with Roux' serum on animals?—Yes.

26,209. Could you give us the details of those experiments?—A series of experiments was made with Roux' serum and Galeotti's serum.

26,210. Give us the general results of those experiments?—The results are given in following table:—

TABLE I.—EXPERIMENTS made to TEST the PROTECTIVE POWER of ROUX' and GALEOTTI'S ANTI-PLAGUE SERA.

Number of Guinea-pig.	Amount of plague culture injected.	Amount and kind of serum which was injected.	Date on which foregoing inoculations were made.	Result.	Remarks.
Number 1 (control) -	$\frac{1}{10}$th agar tube	Nil.	18.2.99	Died 22.2.99	
„ 2 (control) -	„	„	„	„ „	
„ 3 - -	„	$\frac{1}{4}$ c.c. Roux' serum, *Note* 1 (Horse 21).	„	„ 23.2.99	
„ 4 - -	„	$\frac{1}{2}$ c.c. Roux' serum, (Horse 21).	„	„ 21.2.99	
„ 5 - -	„	1 c.c. Roux' serum (Horse 21).	„	„ 1.3.99	Much local re-action, *vide infra Note* 2.
„ 6 - -	„	2 c.c. Roux' serum (Horse 21).	„	„ 2.3.99	Much local re-action, *vide infra, Note* 4.
„ 7 - -	„	$\frac{1}{4}$ c.c. Galeotti's serum *Note* 2 (Horse No. 3).	„	„ 22.2.99	
„ 8 - -	„	$\frac{1}{2}$ c.c. Galeotti's serum (Horse No. 3).	„	„ 25.2.99	
„ 9 - -	„	1 c.c. Galeotti's serum (Horse No. 3).	„	„ 22.2.99	
„ 10 - -	„	2 c.c. Galeotti's serum (Horse No. 3).	„	„ 20.2.99	

In each case the serum and plague culture were injected within a few minutes of each other into opposite sides of the body. In each case the presence of plague bacilli in the body was verified after the death of the animal.

NOTE 1.—This serum was kindly placed at the disposal of the Plague Commission by M. Roux, of the Pasteur Institute, Paris. The following particulars with respect to the method which was employed for the preparation of this serum were also very kindly communicated by M. Roux. "The anti-plague serum from horses 21 and 31 was prepared in the following way:—The "horses first received dead cultures of plague bacilli subcutaneously; afterwards they received dead cultures by intravenous "injection. Lastly, they received living cultures by intravenous injection."

NOTE 2.—This serum, which was prepared by Dr. Galeotti for the Municipality of Bombay, was furnished to the Plague Commission by that gentleman. It was accompanied by the following note with respect to the procedure which was adopted in its preparation. "Horse No. 3 received the following inoculations of nucleo-proteid which was prepared by Professor Lustig's "process from culture of plague bacilli:—

" Nov. 23rd 1898.	0·11 grammes.	
" Nov. 17th „	0·92 „	
" Dec. 9th „	2·85 „	
" Jan. 2nd 1899.	1·53 „	
" Jan. 10th „	1·59 „	
" Feb. 5th „	2,000 c.c. blood extracted.	The serum was employed on plague patients in the Arthur Road Hospital.
" Feb. 7th „	4,000 c.c. blood extracted.	The serum is sent herewith to the Plague Commission."

continued on page 333.

* *See* Appendices No. LXXX. and LXXXI. in this Volume.

26,211. The general result of that experiment was that Roux' serum appeared to have a certain effect in delaying death?—Yes, considerable.

26,212. And Galeotti's serum rather the opposite effect?—Yes. There was another series of experiments done in the same way.

26,213. Can you give us those?—Nine guinea-pigs were taken, and all received the same dose of plague. Four received 2 c.c., 1 c.c., ½ c.c, and ¼ c.c. respectively of Roux' serum; another four received ¼ c.c., 2 c.c., 1 c.c., and ½ c.c. of Galeotti's. The results are given in the following table:— *Lieut. S. R. Douglas, I.M.S.* 21 Mar. 1899.

TABLE II.—Further EXPERIMENTS made to TEST the PROTECTIVE POWER of ROUX' and GALEOTTI'S ANTI-PLAGUE SERA.

Number of Guinea-pig.	Amount of plague culture injected.	Amount and kind of serum which was injected.	Date on which foregoing inoculations were made.	Result.	Remarks.
Number 1 (control) -	$\frac{1}{10}$th agar tube	Nil.	27.2.99	Died 4.3.99	
„ 2 - -	„	¼ c.c. Roux' serum, (Horse No. 31) *Note* 1.	„	„ 5.3.99	Marked local reaction.
„ 3 - -	„	½ c.c. Roux' serum (Horse No. 31).	„	„ 6.3.99	do.
„ 4 - -	„	1 c.c. Roux' serum (Horse No. 31).	„	„ 29.2.99	No cause of death detected, no plague bacilli were detected either microscopically or by cultivation.
„ 5 - -	„	2 c.c. Roux' serum (Horse No. 31).	„	„ 8.3.99	Marked local reaction, a few plague bacilli in spleen.
„ 6 - -	„	½ c.c. Galeotti's serum (Horse No. 1) *Note* 2.	„	„ 3.3.99	
„ 7 - -	„	1 c.c. Galeotti's serum (Horse No. 1).	„	„ 3.3.99	
„ 8 - -	„	2 c.c. Galeotti's serum (Horse No. 1).	„	„ 3.3.99	
„ 9 - -	„	4 c.c. Galeotti's serum (Horse No. 1).	„	„ 3.3.99	

The method of experimentation was the same as in the former series of experiments.
Plague bacilli were detected after death in all the guinea-pigs with the exception of guinea-pig No 4.

NOTE 1.—This serum was kindly placed at the disposal of the Plague Commission by M. Roux.
The particulars with regard to the method of preparation which was employed for the preparation of this serum, which were furnished by M. Roux, have been already given. (*Vide* Note 1 on page 322 of this Volume *supra*.)

NOTE 2.—This serum was prepared by Dr. Galeotti for the Municipality of Bombay. The following particulars with regard to the method of preparation were kindly furnished by Dr. Galeotti:—

Horse No. 1.

Nov. 17, 1898.	Plague-nucleo-albumen	0·18 grammes.
Nov. 28, „	„ „	0·57 „
Dec. 12, „	„ „	1·38 „
Dec. 29, „	„ „	3·97 „
Jan. 21, 1899.	„ „	1·23 „
Feb. 15, „	Bled 2,000 c.c.	
Feb. 17, „	„ 3,500 c.c.	

This horse was inspected by Professor Wright and Dr. Ruffer on March 2nd, 1899. He was then in a fairly good condition and had a sleek coat. He was said to have reacted less to the injections than any of the six other horses.

26,214. (*The President.*) What was the time between the administration of the virus and of the serum?—They were done at the same time. The serum was injected into one side, and the virus of plague simultaneously into the other.

26,215. (*Dr. Ruffer.*) Practically the same result was obtained in this case? That was Galeotti's serum from horse No. 1, and Roux' serum from horse No. 31?—Yes. The effect of Galeotti's serum was also tried on rats. Seven rats were taken, two were kept as controls, having received ½ c.c. of an emulsion of plague bacillus. All the others received the same dose. One of these rats received at the same time 2 c.c. of Galeotti's serum in the opposite side of the body; another rat received 1 c.c., another ½ c.c., another ¼ c.c., and another ½ c.c. of Galeotti's serum. The results of those up to date are that one control died in four days; the 2 c.c. Galeotti died in two days, and the ¼ c.c. Galeotti died in three days. In all these plague bacilli were found after death. The other control, and the remaining rats who received the serum are well up to date, and most probably immune.

26,216. Practically, that experiment agrees with the former series of experiments?—Yes.

26,217. Have you any more experiments in regard to the serum on animals?—Yes, but not as regards the protective value of Roux' or Galeotti's.

26,218. (*Prof. Wright.*) You made an experiment with the normal blood, comparing with Roux', in order to ascertain whether it had any immunizing power?—It is going on now. The control guinea-pig, and the guinea-pig which received normal horse blood, are dying. (Note by witness on revising proof of his evidence, "since dead.") The guinea-pig which received 2 c.c. of Roux' serum from Horse No. 21 is still alive, but with marked local reaction.

26,219. (*Dr. Ruffer.*) Did one receive Galeotti's serum?—No, not in that experiment.

This horse was inspected by Professor Wright and Dr. Ruffer on March 2nd, 1899. He was in very bad condition, was apparently feverish, was lame, and was covered with unhealthy half-healed sores.

NOTE 3.—Particulars of *post-mortem* examination of Guinea-pig No. 5. Abscess at seat of inoculation on left side of abdomen, bubo in left axilla. Pleural effusion on left side. Nodules in left lung. In all of these situations plague bacilli were detected on microscopic examination. No generalised infection. No plague bacilli were detected either microscopically or by cultivation in spleen, liver, or blood.

NOTE 4.—Particulars of *post-mortem* examination of Guinea-pig No. 6. Abscess at seat of inoculation on left side of abdomen. Suppurating buboes in both axillæ and both groins. Effusions in both pleural cavities. Lungs filled with hard greyish-yellow nodules. Plague bacilli were found scattered in small clumps through these nodules. Bacilli were recovered by cultivation from the suppurating buboes. Only a single colony was obtained in the cultivation made from the spleen.

Lieut. S. R. Douglas, I.M.S.

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26,220. Can you give us any facts as to the diagnosis of plague by sedimentation and agglutination?—Three sets of capillary sedimentation tubes were put up. Two of these were filled in with plague bacilli and with the diluted serum of a convalescent plague patient. The dilutions employed were respectively 1 in 10, and 1 in 50. Two other capillary sedimentation tubes were filled in with plague bacilli and with my own serum in the same dilutions and a further capillary tube was filled in with an equal quantity of normal saline solution, and of an emulsion of plague bacilli. In all of these the sedimentation was equal. The agglutination test has also been applied several times under the microscope, using a mixture of plague bacilli and normal saline solution as a control, and no marked difference can be seen.

26,221. So that you do not know of any method at present by which you can diagnose plague either by sedimentation or agglutination?—No.

26,222. That is a diagnostic method which is useless at the present time?—Yes.

26,223. Have you any other experiments on the same point?—With regard to Pfeiffer's reaction, that has been tried three times in the case of guinea-pigs, with Roux' serum. It gave doubtful results in the first case, and very doubtful positive results in the other two.

26,224. Would you kindly explain exactly how you did it?—A guinea pig was taken, and into the peritoneum of this guinea pig I introduced a small quantity, about 1 c.c. of Roux' serum, and about 1 c.c. of thick emulsion of plague. Then at intervals of one minute, two minutes, three minutes, and 5 minutes, portions of the peritoneal fluid were drawn off, and examined under the microscope. In the first case, I thought spherulation was seen very well, but in the other cases it was not at all marked. The same experiment was performed with Galeotti's serum, and the spherulation seemed to be fairly marked in that case.

26,225. How long was it before it showed itself?—It showed it best in five or six minutes.

26,226. Did any of those animals die?—I know of two of the Roux' animals that died, but I am not sure about the third. It was well some time afterwards when I saw it.

26,227. Can you give us any facts as to the involution forms of plague bacilli as seen in animals after death?—In a cat that was inoculated here, at the seat of inoculation there was a quantity of lymph thrown out, and in this there were some forms of longish bacilli, and they looked like the involution forms seen on agar cultures. Also in the peritoneal exudation of a guinea pig that had been inoculated under the skin, the same appearance was seen in one case.

26,228. Did you see it anywhere else?—No, those are the only two cases.

26,229. Did not you see it in the rabbit that was inoculated with the urine of a plague patient?—No.

26,230. Did not these involution forms look very much like saprophytes when you saw them first? Could they not be easily mistaken for some other kind of microbe?—Certainly.

26,231. So that there is a possibility of error?—Yes.

26,232. Have you any other facts bearing on that?—No.

26,233. Have you any facts bearing on the growth of plague in various gases?—I have some facts bearing on the growth of plague in carbon di-oxide. These researches in question were suggested by Dr. Marsh's experiments on the effect of burying plague cultures in earth. I believe Dr. Marsh also did this experiment. It was thought that CO_2 might have an influence on the growth of plague. A broth tube was inoculated with plague bacilli, and a stream of carbon di-oxide passed through it, and the tube was then sealed, a control being made from the same source at the same time. The growth in the tube containing the carbon di-oxide appeared to be more abundant two or three days afterwards.

26,234. Have you got one experiment on that or several?—Several.

26,235. In each case it was the same?—No, not in each case; the results have not been constant.

26,236. (*The President.*) What were the results in the other cases?—In some cases the tubes were contaminated, and therefore you could not get a result at all. In others there did not seem to be any difference in the growth.

26,237. (*Dr. Ruffer.*) It is not a constant phenomenon?—No.

26,238. Can you tell us anything with regard to the channels of infection of various animals? I think we had better begin with monkeys. The monkeys that you used were all brown monkeys, were they not?—Yes. Monkeys inoculated under the skin have died, as a rule, in about five days. One monkey that had a few drops of plague culture dropped into its nose, took seven days to die. In two cases in which plague bacilli were inoculated into the trachea of monkeys, they each died in three days, and in those cases the lungs were almost solid—like the lungs in croupous pneumonia. One monkey was inoculated in the vagina, some plague culture being put up the vagina, and this died in seven days, and plague bacilli were found in its organs. There was in this case a good deal of local re-action. One monkey had a small quantity of plague put into one eye.

26,239. On the conjunctiva?—Yes, on the conjunctiva, and that died in six days.

26,240. Did you find that the glands nearest to the point of inoculation were always more enlarged than the other glands?—In all these cases, except in the cases of the trachea, where there was no marked enlargement of glands.

26,241. Did you try to infect monkeys by the mouth?—No, not monkeys; but some were inoculated intravenously.

26,242. What were the results of your intravenous injections?—One monkey recovered. In one monkey, the plague bacilli seemed to have leaked into the wound and affected the glands just above.

26,243. Did that animal die?—Yes, that animal died with a bubo above the wound. Another monkey received intravenously eight-tenths of an agar culture injected by means of a glass cannula, and it died two days later with very few bacilli found in its organs, and none in its blood. Cultures were made, but I have not examined them yet. Another monkey received four-tenths of an agar tube, intravenously, and died three days after injection. It had plague bacilli in its organs—more than the one which I have referred to above—but I could not see any in its blood, and the cultures have not developed yet. Another monkey received two-tenths of a tube, intravenously, and died in four days.

26,244. Did you find any bacilli in its blood?—Yes, in that one they were swarming.

26,245. Have you any other experiments on monkeys that you can give us? I think in some cases you obstructed the circulation of a limb in which plague had been injected?—Yes, in one case. The right femoral and the left brachial artery were tied, and then into each of the four limbs ¼ c.c. of the same plague emulsion—that is one-fortieth of an agar culture—was inoculated, and that monkey died in three days. Buboes were found in all four limbs, in both axillæ and in both groins.

26,246. Were they most marked on the side in which you had tied the artery?—No, there was no difference noticed.

26,247. Have you any other experiments bearing on the same question?—The right femoral and left brachial veins were tied in one monkey, and one-fortieth of a tube was injected into each limb; that monkey took four days to die. No difference was found in the size of the buboes.

26,248. Did you find when an animal was injected, and died, after inoculation in the veins, that the blood and the organs contained more or less bacilli than when it is injected under the skin?—When the animals died quickly, there were decidedly fewer bacilli in the organs.

26,249. They died quicker than when injected under the skin?—They had very much larger doses.

26,250. You cannot make any comparison between the two?—No, not definitely.

26,251. Can you tell me anything about the presence of bronchial symptoms in plague patients during the present epidemic?—They seem to be exceedingly numerous. I think, out of my 13 cases that I treated with Roux' serum, that six or seven had bronchial symptoms.

26,252. What do you mean exactly by bronchial symptoms—not pneumonia?—No, not pneumonia.

26,253. You mean any other symptoms connected with the affection of the lungs—such as bronchitis, or œdema of the lungs?—Yes, and any slight symptoms or physical signs.

26,254. Most of those patients have a cough, have they not?—Many of them cough, but not all of them cough that have the symptoms.

26,255. Do they expectorate?—Freely.

26,256. Can you tell me anything about the presence of the bacilli in the sputum in non-pneumonic cases, in bubonic cases?—Out of 13 bubonic cases, bacilli were found microscopically seven times, and five of those had buboes other than in the cervical, or sub-mental regions.

26,257. Were you ever able to isolate it in non-bubonic case by culture?—No, not from the sputum.

26,258. But there may be quite enough microbes in the sputum to make a diagnosis of plague?—They were exactly like plague.

26,259. Were you ever able to find plague bacillus in the discharge from the nose?—In one case where the patient had sub-mental buboes, and a bloody discharge from the nose.

26,260. You were able to prove those by inoculation, were you not?—Yes, I proved by inoculation that these bacilli were true plague bacilli.

26,261. Can you tell me anything about the presence of plague bacili in the blood?—In a total of six examinations of the blood of plague patients I found plague bacilli in three; one man recovered, one man died 24 hours afterwards, and the other died five days afterwards.

26,262. In these cases, were the plague bacilli numerous?—In the case of the patient who died the next day, they were very numerous; in the other two they were very few.

26,263. In one of them it did not grow in agar, but it did in bouillon?—Yes, in one case a growth was obtained in bouillon but not in agar.

26,264. Did you examine the pus from the buboes? Were you ever able to find the plague bacillus in a bubo which had opened spontaneously, or had been opened after suppuration?—No, never.

26,265. You found a lot of other micro-organisms, did you not?—Yes, in three cases other micro-organisms were found.

26,266. What micro-organisms did you find?—Staphylo-ooccus pyogenes aureus in two cases, and a bacillus resembling the bacillus coli in other cases.

26,267. Did you find the bacillus coli in other cases resembling plague?—I found the bacillus coli in an abscess in a boy's scalp.

26,268. Were you able to find the plague bacillus in the urine of plague patients?—I examined for it in three cases. In none of these was a cultivation of the plague bacillus obtained. The method employed was as follows:—The urine was drawn off with a sterilised catheter, and passed straight into a tube of bouillon. These tubes were always found contaminated. In five cases in which the urine was inoculated into the peritoneal cavity of an animal, one gave a positive result, the animal died with typical plague bacilli in its organs.

26,269. (*Prof. Wright.*) Have you any facts that bear upon the sterility of Haffkine's fluid? Have you, for instance, any knowledge that some of the bottles are obviously putrid?—Some of the bottles when opened smelt very strongly, a very foul smell.

26,270. Do you think a putrid smell would arise if carbolic acid had been added to the particular bottles you speak of?—It might, I think.

26,271. We have had it in evidence that M. Haffkine standardises his prophylactic by shaking up the sediment, and judging of the turbidity of the fluid. Do you think it is probable that the sediment contains other substances also, in addition to bacteria?—It certainly might.

26,272. What experiments have you made to determine that there is an equal amount of sediment in the doses prescribed on the bottles?—A series of filter papers was folded up and then dried and sterilized at 110° C. in a hot chamber. They were then put into test tubes which had also been dried, corked, and allowed to cool. That done, the tubes with the contained filter papers were weighed on a chemical balance. Each filter paper was then placed in a funnel, and a bottle of Haffkine's fluid was opened, and the contents of this, after they had been measured, were filtered through the dried filter paper. The filtrate which passed through the filter was in all cases *water-clear*. The paper and the contained sediment were then dried at 110° C. This done, the filter papers were put back in the same test tubes, corked with the same corks, and allowed to cool, and then re-weighed. The difference in weight gave the amount of the sediment in the quantity of Haffkine's fluid which had been filtered. The dose which was prescribed for that particular bottle was ascertained from the label on the bottle, and the number of doses which were contained in the quantity which had been filtered was then calculated out. Finally, from these data the weight of sediment which was contained in each dose was ascertained.

26,273. Were the bottles which were tested selected at random?—Yes.

26,274. What were the results?—In all, ten bottles, derived from ten different brews, were examined. The results which were obtained are exhibited in the following table:—

TABLE III.—Showing the different WEIGHTS of SEDIMENT which may be contained in a prescribed DOSE of HAFFKINE'S PROPHYLACTIC.

Number of Brew.	Volume of the Prophylactic which was passed through the Filter.	Volume of Prophylactic which was prescribed as a Dose.	Combined Weight of the Test-Tube, Cork, and dried Filter Paper.	Combined Weight of the Test-Tube, Cork, dried Filter Paper, and Sediment.	Weight of the Sediment in total Quantity filtered.	Weight of Sediment in prescribed Dose.
4552	100 c.c.	10 c.c.	13·225 grm.	13·3065 grm.	0·0815 grm.	0·0081 grm.
6482	70 „	5 „	10·1135 „	10·265 „	0·1515 „	0·0108 „
6038	69 „	6¼ „	10·055 „	10·2075 „	0·1525 „	0·0138 „
4243	100 „	5 „	17·343 „	17·657 „	0·314 „	0·0157 „
6174	62·5 „	6¼ „	17·3565 „	17·517 „	0·1605 „	0·016 „
3923	105 „	15 „	9·129 „	9·242 „	0·113 „	0·016 „
5312	62·5 „	6¼ „	11·3305 „	11·5055 „	0·175 „	0·0175 „
5182	75 „	10 „	13·148 „	13·4225 „	0·2745 „	0·036 „
4823	62·5 „	12·5 „	12·2735 „	12·4675 „	0·194 „	0·038 „
5108	42·5 „ *Note* 1	15 „	9·640 „	9·7995 „	0·1595 „	0·0563 „

NOTE 1.—The bottle of prophylactic which was employed for the estimation contained only 42·5 c.c. of fluid.

26,275. I understand the weight of the sediment contained in a dose of Haffkine's prophylactic is in some cases seven times larger than in other cases?—Yes.

26,276. And if the toxine in the fluid is in proportion to the sediment, it would result that one dose of prophylactic may contain not only seven times more of the sediment, but also seven times more of the dissolved toxine, than another dose of the prophylactic?—Yes.

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26,277. Have you made any experiments to determine whether Galeotti's serum is more toxic than normal horse serum?—Yes, I made the following experiments:—

TABLE IV.—COMPARISON of the TOXICITY of GALEOTTI'S SERUM with the TOXICITY of NORMAL HORSE SERUM.

Number of Guinea-pig.	Weight of Guinea-pig.	Amount and Kind of Serum which was injected.	Relation of foregoing Amount to Body Weight of Animal.	Result.
	Grammes.		Per Cent.	
Number 1	230	Galeotti's serum 11·5 c.c.	5	No toxic symptoms observed.
„ 2	220	Normal horse serum 11 c.c.	5	Do.
„ 3	260	Galeotti's serum 19·5 c.c.	7·5	Do.
„ 4	260	Normal horse serum 19·5 c.c.	7·5	Do.

26,278. You draw from these experiments an inference that Galeotti's serum is not appreciably more toxic that the normal serum?—To normal animals it does not seem to be appreciably more toxic.*

26,279. In view of the fact that you found that animals that have received Galeotti's serum have died faster, when inoculated with plague, than normal animals, do you infer that there are probably unneutralised toxines in Galeotti's serum?—Yes.

26,280. Have you made any experiments with a view to determining whether a more effective therapeutic serum could be obtained by combining together two or more varieties of such sera?—Yes, I took two rabbits and inoculated them preventively, with a very large dose of Roux' serum. I then further gave them an injection of plague bacilli. These rabbits had high temperature after this, but they both recovered. One rabbit had received 35 c.c. of Roux' serum, and the other had received 55 c.c. After ten days they seemed perfectly well, and some of their blood was drawn off, and the serum collected. Then the following experiments was made:—

* For further confirmation of this result *vide* Table V. in Lieut. Liston's evidence below.

TABLE V.—EXPERIMENTS made to DETERMINE the PROTECTIVE POWER of various ANTI-PLAGUE SERA and of various COMBINATIONS of ANTI-PLAGUE SERA.

Number of Guinea-pig.	Nature and Quantity of the therapeutic Serum which was injected.	Dose of Plague Bacilli which was injected.	Date on which the foregoing Injections were made.	Result.	Remarks.
No. 1 (control)	Nil	$\frac{1}{10}$ agar tube	14.3.99	Died 18.3.99	
„ 2 (control)	Nil	„	„	„ 19.3.99	
„ 3	2 c.c. Roux' serum (horse 21)	„	„	„ 23.3.99	Much local reaction.
„ 4	2 c.c. Galeotti's serum	„	„	„ 17.3.99	
„ 5	2 c.c. serum from immunized rabbits.	„	„	„ 19.3.99	
„ 6	1 c.c. Roux' serum + 1 c.c. Galeotti's serum	„	„	„ 21.3.99	Much local reaction.
„ 7	1 c.c. Roux' serum + 1 c.c. immunized rabbits' serum	„	„	„ 23.3.99	„ „
„ 8	1 c.c. Galeotti's serum + 1 c.c. immunized rabbits' serum	„	„	„ 17.3.99	
„ 9	0·5 c.c. Roux' serum + 0·5 c.c. Galeotti's serum + 0·5 c.c. immunized rabbits' serum	„	„	„ 19.3.99	
„ 10	1 c.c. immunized rabbits' serum	„	„	„ 22.3.99	Much local reaction.
„ 11	0·5 c.c. immunized rabbits' serum.	„	„	„ 17.3.99	

In each case the serum and plague bacilli were injected into opposite sides of the body. The serum was in each case injected a few minutes before the plague bacilli. In every case plague bacilli were found after death in pure culture in the internal organs.

Each of the guinea-pigs which were employed for this experiment weighed approximately 350 grammes.

26,281. Have you noticed a characteristic smell in plague cultures?—Yes.

26,282. Do you think that the smell is an important aid in diagnosing plague?—I do not think it is very important. I have never found anything smelling like it myself.

26,283. Have you made any experiment to determine whether it is possible to infect an animal with plague by means of the food?—Two experiments were made. In the one case two rabbits were taken. They each had a whole agar culture of plague, emulsified in broth, put into the stomach by means of a stomach tube. One of those died 21 days afterwards, but no plague bacilli were found in any of its organs, and neither did we find anything resembling plague. The other one is still alive. In another case, a mouse was fed upon the spleen of an infected rat, and it died. Plague bacilli were found in its organs, but you cannot say that that is a proof that it died from eating the spleen.

26,284. With regard to the monkey that died after the injection of plague bacilli into the vagina, were there buboes in the groin?—There were buboes in both groins, and the lumbar glands were very much enlarged.

26,285. Do you think that the prevalence of inguinal buboes may stand in relation with the fact that plague may be absorbed into the system by way of the genital tract?—They might be.

26,286. (*Dr. Ruffer.*) Did you try to infect a male monkey by means of the genital tract?—Yes, but it was unsuccessful. The monkey had been used for another experiment.

26,287. (*The President.*) In those experiments in which you tried the antidotal power of the serum, how did you

approximately determine the dose of virus so as to know that you gave the same dose of virus to each of the animals?—A. mass of culture plague was taken, and a certain quantity of broth was put into that; all the bacilli were scraped off the surface of the agar, and made into an emulsion with this broth; then it was drawn up into a syringe, and an equal quantity given to each.

26,288. What was the relationship of this dose to the smallest dose which you gave of the serum? How far did it exceed the smallest quantity?—One-tenth of a mass of culture of an agar tube was given in one case, and in the other I think it was the same.

26,289. Have you any data to show what relationship the dose you administered would bear to the smallest dose that would kill the animal?—I do not know what the smallest dose is, it being impossible, as far as I know, to find out the minimum lethal dose of a living virus.

26,290. You do not know whether it was 100 times more or 50 times more?—Certainly not.

26,291. I suppose it is impossible, if you have an enormous amount of virus introduced into an animal, to prevent death, by any anti-toxic serum, in that animal?—Certainly; all the animals died. Those who were inoculated with Galeotti's serum died before the animals which had nothing but plague.

26,292. You do not know how much above the quantity that was capable of producing death, the dose of the virus which you administered in these test experiments had been?—Certainly not.

26,293. It may have been 100 times?—It may have been 100 times.

26,294. (*Prof. Wright.*) Do you infer from the fact that the controls lived for four or five days in each experiment that the dose of plague administered cannot have been very great?—It cannot have been very excessive.

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26,295. Do you think it could have been 100 times?—I should think that it would have killed quicker if it had been 100 times.

26,296. (*The President.*) Did you record the weight of the animals in all those cases?—The guinea-pigs were picked as nearly the same size as possible. They were not weighed.

26,297. In the series of observations on patients which you have made, I observe that you do not always state the day of illness. Could you put that in?—It is put in in every case except one in that series.

26,298. There are two or three here in which it is not put in. Do you think it would be possible to obtain that information? If you could fill in this column it would be very important?—It is filled in on the notes if it is not filled in on the chart.*

26,299. In those cases where you have found the plague bacillus in the sputa, which also were cases in which the lungs or bronchi were affected, did you look for pneumo-cocci?—We looked for them microscopically.

26,300. Did you find any pneumo-cocci?—Certainly.

26,301. Always?—No, not always; we found it as frequently in ordinary normal sputum.

26,302. Did you examine any discharges from the nares which had not blood in them?—No. I only did one case.

26,303. Did you make any experiments by introducing the virus with food substances into the alimentary canal?—It was a pure culture that was put down into the stomach of a rabbit by means of a stomach tube.

26,304. Not mixed with food?—No.

* *See* Appendices Nos. LXXIX., LXXX., and LXXXI. in this Volume.

(Witness withdrew.)

Lieut. H. J. Walton, M.B., F.R.C.S., I.M.S., called and examined.

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26,305. (*The President.*) I believe you are in the Indian Medical Service?—Yes.

26,306. You have also been engaged in special laboratory investigations with plague virus, I think?—Yes.

26,307. What are your medical qualifications?—M.B., London University, F.R.C.S., England.

26,308. Would you tell us what previous experience you have had in similar work?—I had fifteen months' plague duty before I came here; I had five months' experience of plague work on the railways, two months in Bombay city, three months at Satara, and five months in the Punjab.

26,309. What laboratory experience have you had prior to this?—I have worked at St. Bartholomew's Hospital, under Dr. Kanthack, and I have worked at Netley.

26,310. You first endeavoured to determine the susceptibility of various animals to plague?—Yes, I did.

26,311. Will you give us the information you obtained with regard to rats?—I find the Bombay rats are very frequently immune. If you have two rats and give them equal quantities of the same plague emulsion, one will sometimes die and the other will show no symptoms at all. I have notes of five rats which were inoculated with plague from a source which was known to be virulent to other rats, and they showed no symptoms at all. One rat I have now which was inoculated three times with very large doses, but it has never had any symptoms of any kind. I have also tried the effect of passing plague through rats—killing a rat with plague; taking its spleen and emulsifying it and injecting it into a second rat, and when the second rat dies, into a third and so on. I have done two series of experiments. The second series was a double series, so that practically there were three series of experiments. I have never succeeded in killing more than three rats in succession. The spleen was emulsified at once and injected at once; it was not allowed to grow in broth, it was emulsified and injected immediately. I emphasize that because I think it is possible that if a spleen were taken from a rat and then allowed to grow in broth, in a short time it might become more virulent. I have no experiments on the subject, as I have not had time. I find that by this method of taking a series of rats the first rat usually dies quickly—in three or four days; I have killed them in two days. The second and third rats generally take longer to die. I have never got beyond the third rat. One of these third rats, died after six days. Its blood and all its organs were examined but no bacilli were found at all. Its heart's blood was planted on agar and nothing grew. I have also tried to infect rats through the nose by dropping broth cultures of plague upon the nostrils. I have done that twice, but I did not succeed in killing the rats.

26,312. The result seems to show that there is no intensification of the virus?—Yes; but on the contrary, I think the virulence diminishes.

26,313. There was attenuation?—I think so. This is probably not quite the method of Nature. The spleen was taken out as soon as the animal was dead and immediately injected.

26,314. You have not endeavoured to obtain cultures from the blood or to isolate the bacillus in the blood in each of those generations?—I have in the third rat, of the second series. I did not in the first series, because I expected to kill more rats. But in the second series I did, and as I say, I could grow nothing and I could see no organisms in it.

26,315. Have you made experiments with pigeons also?—I have made three experiments on pigeons by injecting large quantities of plague under the skin, but none of the pigeons died.

26,316. Have you experimented on cats?—I only inoculated one cat. That was inoculated under the skin also and it died after six days. It seemed to be rather resistant. There was a good deal of local reaction—I think more local reaction than I have seen in any other animal. Its blood and all the organs were full of plague.

26,317. Did you give a very large dose?—Yes, it had a large dose.

26,318. What has been your experience with regard to monkeys?—I have inoculated monkeys subcutaneously, intravenously, by the trachea, by the conjectiva, and by the nose, and they have died with all those methods. The shortest time was the subcutaneously inoculated monkey which died in two days. Three or four days is about the average. I have notes here of two, three, and four days.

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26,319. In the case of the intravenous injection?—One monkey died after two days. Here again, I have four, four and two days. In one of those four I am not quite sure it was really intravenously inoculated; I think that the cannula may have leaked a little.

26,320. Have you administered plague virus by the digestive canal?—I have tried that on mice, but not on monkeys.

26,321. What was the usual period between stomach-administration and death?—Subcutaneously, I think, in monkeys it was between three and four days.

26,322. With regard to mice, did you find them very susceptible?—I found mice very susceptible indeed.

26,323. How did you ascertain that?—I once intended to inoculate one mouse with plague, but the tube from which I was going to inoculate it was mislaid. I had already used up the contents of the syringe on another mouse, so I pricked this mouse with the empty syringe. There might have been a very little adhering to the inside of the needle. The mouse died as quickly as the one that had received a considerable dose under the skin. Another thing is that they die very quickly. You can kill a mouse with quite a small quantity of plague in four hours. I have killed mice in four hours by injecting into the peritoneum. Under the skin, I think the shortest time was about eight hours. These were all tame mice. I have not tried any wild ones.

26,324. Did you find the virus of plague in these mice?—Yes. All the organs were full of plague bacilli and the blood was full of plague bacilli. One mouse I fed on the spleen of a plague rat. The spleen was very full of bacilli and the mouse was given water, but no other food. I examined the mouse before I put it in, and I saw no abrasions or cuts of any sort. It died in two days. Some of the spleen had disappeared. It had no other food. The spleen and the liver contained numerous plague bacilli.

26,325. Within what time did death occur?—Two days. That is the only experiment I have done by the mouth.

26,326. Were plague bacilli found in the organs?—Yes, in the spleen and in the liver.

26,327. Have you administered the virus in any other way in the case of mice?—Yes. I have injected into the peritoneum and subcutaneously.

26,328. Are those the only two ways?—Yes, and that one instance by the mouth. Those are the only ways I have tried.

26,329. You have made experiments with earth, I believe?—I did some experiments with earth to see if I could find any bacillus that resembled plague, or bacilli that were plague. Dr. Spencer was examining Bombay earth and I was trying earth from other sources. I examined a sample sent from Calcutta. There did not seem to be anything special about the history of the earth. It came from under a staircase in a house, but there was no note that there had been plague in the house, I plated this earth on agar after putting it in broth. A great many things grew, and I managed to isolate seven distinct micro-organisms. Amongst these there was a bacillus which looked like plague under the microscope. It stained in the way that plague does, and it was very much of the same shape as plague. On the original plate this bacillus grew unlike plague; I had no suspicion; it did not look at all like plague. It was a small round pale colony with concentric rings round it. It grew very slowly; I think it was six or seven days before I saw this colony on the plate. I have a note here that at the end of six days the diameter of the colony was about that of a pea. It was not a very fast-growing bacillus. The bacillus is about the size of the plague bacillus, but it differs from it in being distinctly motile. It does not show a stalactite growth in broth. Another thing I found was that if I made repeated sub-cultures on agar, in the later sub-cultures it grew very much faster, although originally of slow growth. After 24 hours there was a good growth in the later sub-cultures. It showed well-marked bi-polar staining, and it showed forms like the involution forms of plague. In fact, when I showed the bacillus to anybody I usually with a view to astonishing them, told them that it was not plague, because it looked so much like it.

26,330. Is it pathogenic?—Yes, it is pathogenic. It kills mice and guinea-pigs when injected subcutaneously or into the peritoneum. Mice die in about six hours when a small quantity of emulsion is injected into the peritoneum. I also tried pigeons and rats, but it killed neither.

26,331. Did you find these bacilli in mice?—Yes, but I find that there is some difference between this bacillus recovered from animals and this bacillus as it grows on agar tubes, although, in the former case, it is still rather like the plague bacillus. I have noticed that the blood and the organs of animals which have been killed by this bacillus show many bacilli which are usually distinctly longer and more pointed than those from cultures. In some cases this character is very marked indeed. Sometimes this bacillus stains very irregularly, especially when from the peritoneal cavity; in fact, the conditions in which it most closely resembles plague are when it is taken from a young culture on agar. Morphologically, it is then almost identical with plague. It is pathogenic; it kills mice and guinea-pigs, but it differs from plague in being motile and in being more pointed. In animals it is usually more pointed, but sometimes it is not. It looks very much like plague even from animals.

26,332. What are the pathological changes?—The animals seem to die with intense septicæmia; the blood and all the organs are full of bacilli.

26,333. There is no enlargement of the glands?—No, it produces no buboes.

26,334. You consider it is extremely like plague?—Yes. It was suggested to me that it might possibly be one of the forms of bacilli which produce lactic acid fermentation. I tried lactose broth, but it does not ferment it at all.

26,335. Are you quite certain in your own mind that it is not the plague bacillus?—Yes. I feel quite sure that it is not. It grows much faster than plague. When you look at it very critically it is not quite the same as plague. It does not produce buboes in animals, and it is a motile bacillus.

26,336. You have also made experiments as to the escape of plague from animals?—Yes, but I have not done very many, and I have not had much personal experience of it. I have tried human urine. I have done five or six cases. I once drew off some urine from a plague patient in one of the hospitals seven hours before he died. This was centrifuged, and the sediment was planted out, and I grew from that a bacillus which, in its cultural characteristics and morphologically, closely resembled plague, but it did not appear to be pathogenic, as it failed to kill a rat and a mouse.

26,337. Was it alive?—Yes, it grew. From the blood of the same case a bacillus was grown, which was apparently the bacillus of plague, which did kill rats. At another time I grew a bacillus from the urine of a dead monkey which had been killed by plague; this bacillus seemed to be that of plague. In both these cases, when plague was grown from urine, the plague grew very slowly. I have an impression in my own mind, from these cases and from other cultures I have seen from urine, that the bacillus of plague as obtained from urine grows very slowly. The first cultures, at any rate, grow more slowly when it is from urine than from the blood.

26,338. Are there any other fluids which did not retard the growth of plague?—I do not know. I have no experience of them.

26,339. Have you made experiments with sputum?—Yes. There was one case here at the Port Trust Hospital. The sputum was sent up to the laboratory one day; it contained a great many micro-organisms and also a great many bacilli which appeared to be the bacilli of plague, they were exactly like plague, under the microscope, and they stained like plague. I went down to see this case and all I could find was that the patient was said to have been ill for six days. He had the physical signs of broncho-pneumonia on both sides of his chest; there were no definite areas of dulness; there were râles and rhonchi all over his chest, and he had no bubo. He was treated by intravenous injection by Roux' serum; he had 40 c.c. The next day I heard he was very much better. I saw his sputum again; there were no bacilli like plague in it and the man recovered.

26,340. Have you found much difficulty in recognising the plague bacillus in animals?—Yes.

26,341. What are the chief difficulties?—One difficulty is that it appears to be sometimes associated with other bacilli. When an animal dies of plague, you sometimes find other bacilli in it, as well as plague

bacilli. There was a monkey which was killed by injecting plague cultdre into its trachea, and I made cultures from the lung, the heart's blood, the spleen, and the liver. The cultures from the liver and spleen grew like ordinary plague; the cultures from the lung, which showed a copious growth on agar after 24 hours, looked like plague when examined microscopically, with many involution forms. It was emulsified and injected into the peritoneum of a mouse, which died in four hours. In the peritoneal fluid from this mouse there was a capsulated bacillus. I think it was a bacillus, or at least, a cocco-bacillus. I tried a few experiments with the bacillus. It did not stain by Gram's method, and there was a suggestion that it might be Friedländer's bacillus. I tried this bacillus in lactose broth, and it certainly decomposed it. A great deal of gas was given off, but the gas apparently was not carbon dioxide, and it did not combine with caustic potash. The growth from the heart's blood of the same monkey grew abnormally fast, much faster than I have ever seen plague grow, but when it was injected into the peritoneum of a mouse, the peritoneal fluid and organs contained bacilli, apparently those of plague. One other micro-organism was found in the peritoneum of a monkey which was killed by subcutaneous injection of plague. This was a diplo-coccus, which also was capsulated. I have not done any further experiments with this; it only happened recently, and I know nothing further about it.

26,342. Then I believe you have made experiments on the effect of various external conditions upon the growth of the bacillus?—Yes, I have. I have tried the effect of light, darkness, and temperature on the growth of plague. I find that plague grows fastest in the incubator at a temperature of about 37° C. It grows faster at 37° C. than it does in the ordinary room temperature, taking that to be between 24° C. and 27° C. I tried to see if there was any difference in the rate of growth in darkness and in ordinary diffused light, but I could not satisfy myself that there was. I also tried experiments as to the effect of exposure of plague to direct sunlight. I have done a good many experiments on that, and the result has been very constant in one respect: I have never been able to recover from culture tubes living plague, either from broth or from agar, which have been exposed to sunlight for four hours. I have done several experiments, and exposed it for shorter periods. I have twice recovered it after three hours. In one experiment I did, a broth culture was exposed to the sun for three hours. A sub-culture was then made on agar. Nothing was seen for five days, when a few very minute colonies were noticed, microscopically very much resembling plague. After eleven days there was very little growth. The effect of sunning it for three hours apparently was that it retarded the growth. This culture was emulsified and injected into the peritoneum of a mouse, which died two days afterwards, with numerous bacilli, apparently plague, in the spleen, liver, and blood. Then I repeated the above experiment with an agar tube, and there again I recovered plague after it had been exposed for three hours to sunlight. I also did some experiments by exposing to sunlight plague infected pieces of calico. In one experiment I took six square pieces of thin calico, steeped them in plague culture, and exposed them for three hours to strong sunlight in sterilized Petri dishes in the following manner:—One was covered with one layer of calico, one was covered with two layers of calico, one was covered with three layers of calico, one was covered with four layers of calico, one was covered with five layers of calico, and one was covered with six layers of calico, and exposed for three hours to sunlight. Each piece of calico was then placed in broth for several days. No growth took place, even from the one which had been covered by six layers of calico. I did another sunning experiment with flannel. I took five square pieces of flannel; they were well washed and sterilized, soaked in plague culture, and exposed for 3½ hours to sunlight in a Petri dish with the cover off. One was covered with one layer of flannel, one with two layers, one with three layers, one with four layers, and one with five layers of flannel. When removed and placed in bouillon, typical plague growths resulted, but No. 1 only showed growth after four days. Another experiment was done with the hem of an ordinary calico pocket handkerchief. It was soaked for three days in plague culture; it was then exposed for three hours to strong sunlight in a Petri dish. It was then placed in bouillon. It showed no growth for nearly a week, but then grew vigorously. That rather confirms the previous experiment as to the retardation of growth by exposure to sunlight. Another experiment was done with cotton wool. Ordinary cotton wool was twisted so as form a thickness of ordinary knitting wool. This was soaked in a plague culture, removed to a Petri dish, and exposed to strong sunlight for three hours. When removed to bouillon it showed vigorous growth within 24 hours.

26,343. Have you, in any of your experiments, found sunlight to completely kill the bacillus?—I have never grown it after four hours' exposure.

26,344. What have you to say with regard to desiccation?—Pieces of calico were thoroughly soaked in a plague culture, and then removed to sterilized Petri dishes, and allowed to dry at the ordinary temperature of the room, and in diffused light. Cultures were obtained from a piece of calico for the first four days, and then the experiment was interrupted for six days. On the 11th day no cultures could be obtained. Apparently for the first four days plague can be recovered. I know nothing between four and 11 days; on the 11th day I could not recover it. I also tried another way, by introducing calcium chloride into the same Petri dish. I put sterilized cotton fabric soaked in plague emulsion into a Petri dish in which calcium chloride was placed. At the end of 18 hours the cotton was placed in broth. No growth resulted. Of course, the calico was very dry indeed.

26,345. What has been the general result of your desiccation experiments?—That exposing a plague culture for at least four days to ordinary drying does not kill plague. Of course, there is no reason why it should. It depends upon the amount of broth you use. Apparently it takes four days for a piece of cotton soaked in broth to become so dry that plague will not grow upon it, yet if it is dried very rapidly with calcium chloride, the period of time is much shorter.

26,346. After absolute dryness, how long will the plague bacillus live?—I could not obtain it after 18 hours in one case: I am still experimenting on that subject.

26,347. I believe you have also tested the resistance of plague to various disinfectants?—I have done a few experiments with regard to the resistance of plague to disinfectants. In one experiment I did, an emulsion of plague was made, and of this ½ c.c. was added to the following tubes:—1 in 1,000, 1 in 2,000, 1 in 5,000, 1 in 10,000 and 1 in 20,000 perchloride of mercury. After half-an-hour a loop-full from the above tubes was planted in broth for 12 hours, in order, as far as possible, to eliminate the admixture of the bacillus with the disinfectant. Then sub-cultures were made on agar from each broth tube. I did this with plague, and also with a coccus, which I have found very resistant in other experiments. I found that I could grow the coccus from the tube of 1 in 20,000, but I could not grow plague from any of them. Plague did not grow after being exposed to perchloride of mercury 1 in 20,000 for half-an-hour.

26,348. Did you observe any characteristic odour in the cultivations from broth?—Yes; I think that plague cultures have a very characteristic smell. I think you can smell it in agar, but you can smell it best in broth. I once distilled a broth culture, and the distillate smelt very strongly indeed. It was the same smell, but in a more concentrated form.

26,349. Can you describe the smell?—It is very difficult to describe a smell. It is a very unpleasant smell; I do not think I can describe it any better than that.

26,350. Have you made any experiments on the disinfection of houses?—I went to one house in the C. district in Bombay. Scrapings from the floor and wall were collected before and after disinfection by the disinfecting gang. I was informed that the disinfectant used was perchloride of mercury in the strength of about 1 in 500. A few c.c. of broth were added to the earth samples, and the pledgets of cotton wool which had been used to collect samples of the wall were dropped into broth. The samples were collected immediately after disinfection, while the floor and wall were still wet. Consequently a good deal of the disinfectant was present in the samples. They were plated in Petri dishes. After 24 hours there was no appreciable difference in the number of colonies from the wall before and after disinfection. I do not know what the explanation is. Perhaps it is that the wall is greasy, and the disinfectant does not remain there very long;

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but that is how it was. But in the floor samples there was a difference. The method of disinfection which they adopted was, first to enter the room and squirt vigorously on the floor; then they squirted the walls and the roof, and the disinfectant ran down on to the floor, so that the floor was a kind of pond at the end of the process. I found that the floor samples, which had been taken before disinfection, grew very vigorously, but no growth occurred for the first 24 hours in floor samples which had been taken after disinfection but after three days there was a growth in all of the samples taken, but not of plague. I was not looking for plague; I was trying to find if the process destroyed the ordinary organisms.

26,351. In none of these cases did you identify the plague bacillus, I suppose?—No. There was another experiment which I did, namely, trying the effect of carbolic acid on a wall. A wet sterile cotton wool plug was wiped on the wall and a broth tube inoculated with it. Then five per cent. carbolic acid was squirted over a portion of the wall, which was covered with a Petri dish to prevent air organisms getting there, and left for 10 minutes. Then a second broth tube was inoculated in the same way as the first had been. After 24 hours there was abundant growth in the control tube, and after 48 hours the second tube showed colonies of a spore-bearing bacillus. The result was not very satisfactory.

26,352. It was not very much in favour of carbolic acid?—No.

26,353. What has been your experience with regard to the treatment of plague cases with anti-toxic serum?—I have only treated 15 cases altogether.

26,354. With what serum?—With Roux' serum, from horse No. 31 and horse No. 21. One case I treated at Bangalore. It was a hopeless case. The girl had extensive broncho-pneumonia and was very weak when she came in. She had 28 c.c. of serum and died. Most of my cases were done at the Modi Khana Hospital in Bombay. Another case that I treated, and which I wish to be considered in a separate category, was one at the Port Trust Hospital here. The reason I put it into a separate category is that I had no control. In the Modi Khana cases I had controls to all. This case, in the Port Trust Hospital, is the man I spoke about before, in whose sputum I saw what I believed to be plague bacilli. He had 40 c.c. of the serum injected into his veins and recovered.

26,355. Within what time had he the 40 c.c.?—He had that at once. Then at the Modi Khana Hospital I treated 13 cases with 13 controls.* Alternate cases were taken. I had no voice in the selection of the cases. The doctor in charge of the hospital gave me a case as it came in and said "So-and-so is your control"—that was, as a rule, the next man who came in. I treated 13 cases, of whom 10 died, being a mortality of 76·9 per cent. All the 13 controls died. This was about six weeks ago, when plague was exceedingly virulent. The mortality of the cases treated was 76·9 per cent., and the mortality of the controls was 100 per cent., but of course the numbers are so small that you cannot draw any positive conclusions from those experiments.

26,356. Have you made any experiments on the effect of the serum on the pulse?—I could detect no constant effect of the serum on the pulse, respiration, temperature or symptoms.

26,357. Was the duration of life longer or shorter in the case of those treated with the serum than in the case of the controls?—At first I rather thought myself that it was somewhat longer, but I took the trouble to count the number of days that the fatal cases lived, both those treated with the serum and controls, and I found there was no difference.

26,358. What were the separate doses and total amounts given of the serum?—The most I gave was 220 c.c. to a man who recovered.

26,359. In what time?—He received on an average about 60 c.c. a day.

26,360. For about four days?—Yes.

26,361. What was the largest amount you gave at one time?—The most I ever gave at a time was 40 c.c.

26,362. This was to the man who had 220 c.c. altogether?—Yes, he had 40 c.c. at a time, but so had most of my cases.

26,363. What were the other totals?—They varied between 40 c.c. and 220 c.c.

26,364. I suppose they often died before they had received much serum?—Yes. Very often I would give a man one injection and when I went round in the evening he was dead, so that he never received more than 40 c.c.

26,365. Did you notice much local irritation produced by the larger injections?—No; I have never noticed the slightest local irritation. There is one point about these cases which I should like to mention, and that is with regard to the frequency of lung symptoms. By lung symptoms I mean symptoms of broncho-pneumonia, which seem to be very common in the present epidemic. I find that of the 13 cases I treated, eight had lung symptoms.

26,366. What about the controls?—I cannot tell you about them, but I presume they would come out about the same, because they were not picked in any way. Two of the cases which recovered had lung symptoms, and there was also that case at the Port Trust Hospital which had lung symptoms and recovered.

26,367. On the whole these cases were very unfavourable for any treatment, were they not?—Yes.

26,368. Have you anything else to add?—I have nothing else to say, except with regard to the mortality at the Modi Khana Hospital, among cases treated with Roux' serum. Lieutenant Douglas and I were working together there. We added our cases up and found that the percentage mortality was 81·48, and that in a similar number of controls the percentage mortality was 85·18. But the total number of cases was only 27, so that I do not think you can draw any conclusions in favour of Roux' serum from that.

26,369. (*Prof. Wright.*) You do not think the efficacy of the disinfection of a house can be properly tested by merely comparing the number of bacteria before and after disinfection?—That seems to me to be the only way available. Of course the fact that you cannot find plague is no evidence that a house has been satisfactorily disinfected, because under the most favourable circumstances it is very difficult to recover plague bacilli.

26,370. When you find that the number of bacteria is not reduced by the disinfection process, does it always follow that the house has not been completely disinfected against plague?—No, I do not think so at all. I think there may be resistant micro-organisms and spore-bearing micro-organisms which would not be destroyed by a process which would kill plague.

26,371. You think the disinfection of a house would be adequate if you found that all the bacteria which survived had more resisting power than the plague bacilli?—Yes, I think it might be adequate.

* *See* App. No. LXXXI. in this Volume.

(Witness withdrew.)

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Lieut. W. G. LISTON, M.B., I.M.S., called and examined.

26,372. (*The President.*) You are a member of the Indian Medical Service, and have been on special duty with the Indian Plague Commission?—Yes.

26,373. You have been making special researches in connection with plague?—Yes.

26,374. When did you commence them?—On the 5th December.

26,375. I believe you have endeavoured to determine the sterility or otherwise of Haffkine's fluid?—Yes, I have examined twelve bottles. To test each bottle, two agar tubes were used. The first of those was inoculated with a small quantity of undiluted vaccine. The second was inoculated with exactly the same quantity of vaccine as the previous tube, but this time diluted with four volumes of sterile broth. In all twelve bottles were examined. The date on which the vaccine was prepared was not noted on the bottles. Care was taken to choose only those bottles that had the sealing wax on the corks intact, otherwise the bottles were chosen at random from samples of almost every brew which M. Haffkine had in his laboratory at the time, and which he had kindly sent for examination. Of these twelve bottles nine were found to be sterile, viz., brews

Nos. 9029, 6174, 3927, 6161, 4552, 6112, 4739, 6053, 3993. Three were found to contain micro-organisms, viz., brews Nos. 6151, 3895, and 3911.

No. 6151. Only a single colony grew in the undiluted tube.

No. 3895. Copious growth in undiluted tube of an oval bacillus non-motile, and forming small transparent colonies; similar growth in the diluted tube.

No. 3911. Thirty to forty colonies in the undiluted tube. Nine small colonies in the diluted tube.

26,376. In any of these cases were there any organisms which at all resembled the plague organisms?—No.

26,377. Do you know whether any of the detected organisms are pathogenic or not?—No.

26,378. You have made experiments on the relative toxicity of the supernatant fluid and sediment of Haffkine's fluid?—Yes, and also protectively afterwards. In this experiment six guinea-pigs were used, three receiving doses of the supernatant fluid and three doses of the sediment. The brews used in the experiment were the following:—

Brew. No. 5344, dose 6½ c.c.
" " 5338, " 6½ c.c.
" " 5344, " 6½ c.c.
" " 5315, " 6½ c.c.
" " 5975, " 6½ c.c.
" " 4422, " 2½ c.c.
" " 4414, " 7½ c.c.

These bottles had been standing in the laboratory for some time, and their contents had separated into two portions, a supernatant brown clear fluid and a muddy greyish brown deposit. The bottles were carefully opened and the supernatant fluid drawn off with a sterile pipette. The sediment remaining was freed, as far as possible, of excess of fluid by means of the pipette; a thick emulsion was thus obtained. The supernatant fluids from all the brews were mixed in one flask and the sediments in another. The details of the experiment are given in the following table:—

TABLE I.

DETERMINATION of TOXICITY of the SEDIMENT and SUPERNATANT FLUID of HAFFKINE'S PROPHYLACTIC.

Number of Guinea-pig.	Component of the Prophylactic which was injected.	Dose of the foregoing Component which was injected.	Result.
Number 1	Supernatant fluid	1 c.c. per 100 grammes of guinea-pig's body weight.	Survived.
" 2	"	2 c.c. per 100 grammes of guinea-pig's body weight.	Died 5 days after inoculation. (*Note* 1.)
" 3	"	4 c.c. per 100 grammes of guinea-pig's body weight.	Died 4 days after inoculation. (*Note* 1.)
" 4	Sediment	½ c.c. per 100 grammes of guinea-pig's body weight.	Survived.
" 5	"	1 c.c. per 100 grammes of guinea pig's body weight.	Survived.
" 6	"	2 c.c. per 100 grammes of guinea-pig's body weight.	Survived.

Note 1.—No micro-organisms could be detected after death in the bodies of these animals.

26,379. I understand that anything above 2 c.c. of the supernatant fluid killed them?—Yes, any dose above 1 c.c.

26,380. What is the minimum lethal dose of the supernatant fluid?—2 c.c.

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26,381. The doses you used of the sediment did not exceed 2 c.c.?—No.

26,382. You had only one experiment in which you administered the supernatant liquid in the lethal dose of 2 c.c.?—Yes, we used larger doses of the non-carbolized supernatant fluid, and compared its toxicity with that of the nutrient broth in which the bacillus is grown. A series of guinea-pigs were inoculated with doses of 5, 10, 20, 30 c.c. of broth and non-carbolized supernatant fluid, respectively, eight guinea-pigs being used in all. These guinea-pigs were all inoculated on the 15th March. On the 19th all the guinea-pigs were well except one, which received 10 c.c. supernatant fluid, which died on the 18th, and was found to have in its liver and spleen a few groups of cocci, which stained by Gram's method, so that it is possible that this was an accidental death.

26,383. And could not have been due to the inoculation?—That is so.

26,384. It must have been poisoned in some other way?—Yes. The details of the series of guinea-pigs are as follows:—

TABLE II.

ESTIMATION of the RELATIVE TOXICITY of (*a*) the ORIGINAL NUTRIENT MEDIUM which is EMPLOYED in the PREPARATION of M. HAFFKINE'S PROPHYLACTIC; and (*b*) of the same NUTRIENT MEDIUM (un-carbolized but heated to 65° C. and filtered), after it has served as a CULTIVATION MEDIUM for the PLAGUE BACILLI. —(*Note* 1.)

Number of Guinea-pig. *Note* 2.	Kind of Broth, and Amount of same which was injected.	Temperature of Guinea-pig on the Day after Inoculation.	Final Result, One Week after Inoculation.
Number 1	Haffkine's nutrient medium, 30 c.c.	103° F.	Quite well.
" 2	Haffkine's nutrient medium, 20 c.c.	102·2° F.	" "
" 3	Haffkine's nutrient medium, 10 c.c.	102·8° F.	" "
" 4	Haffkine's nutrient medium, 5 c.c.	102° F.	" "
" 5	Filtrate from plague culture grown in above medium, 30 c.c.	102·6° F.	Quite well, except for fact that there is a small patch of necrosis at site of inoculation.
" 6	Filtrate from plague culture grown in above medium, 20 c.c.	102·4° F.	Quite well, except for small patch of necrosis at site of inoculation.
" 7	Filtrate from plague culture grown in above medium, 10 c.c.	96·8° F.	Died, probably of intercurrent infection (*vide* text *supra*) 3 days after inoculation.
" 8	Filtrate from plague culture grown in above medium, 5 c.c.	103·4° F.	Quite well.

Note 1.—M. Haffkine kindly furnished the material which was employed in this series of experiments. The material consisted of (*a*) a large flask of freshly prepared nutrient medium, such as he employs as a cultivation medium for plague bacilli in the preparation of his plague-vaccine; (*b*) a large flask of the above nutrient medium which had served as a cultivation medium for the plague bacilli, and which had just been heated to 65° C. with a view to converting it into plague-vaccine.

Note 2.—The guinea-pigs which were employed for this experiment were afterwards (*vide* Table VI. *infra*) submitted to a test with a view to ascertaining whether they had acquired any immunity.

It would, therefore, appear that the toxic element of the supernatant fluid of Haffkine's vaccine for guinea-pigs is, probably, the contained carbolic acid.

26,385. You have made some experiments with regard to the protective power of the fluid and of the sediment?—Yes, I made the following experiment. The guinea-pigs which were used were those which survived the experiment reported in Table I. above, and one control guinea-pig. There were three guinea-pigs which survived the doses of sediment and one which survived the dose of supernatant fluid.

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TABLE III.

DETERMINATION of the respective PROTECTIVE POWER of the SEDIMENT and SUPERNATANT FLUID of HAFFKINE'S PROPHYLACTIC.

Number of Guinea-pig.	The Guinea-pig had previously been injected with	Interval that had elapsed since the previous Injection.	Amount of Plague culture which was now injected.	Result.	Remarks.
No. 1 * *Note* 1 (control.)	Nil	-	¼ agar culture	Died 6 days after	Plague bacilli; abundant small nodule in spleen.
No. 2 (No. 1 of Table I. *supra*)	Haffkine's supernatant fluid, 1 c.c. per 100 grms. of body weight.	8 days	Ditto	Died 24 hours after.	No local reaction or buboes; no nodules in organs; abundant plague bacilli.
No. 3 (No. 4 of Table I. *supra*)	Haffkine's sediment, ½ c.c. per 100 grms. of body weight.	Ditto	Ditto	Died 9 days after.	Marked local reaction, nodules in lungs.
No. 4 (No. 5 of Table I. *supra*)	Haffkine's sediment, 1 c.c. per 100 grms. of body weight.	Ditto	Ditto	Died 5 days after	Some local reaction.
No. 5 (No. 6 of Table I. *supra*)	Haffkine's sediment, 2 c.c. per 100 grms. of body weight.	Ditto	Ditto	Died 5 days after	Some local reaction.

* *Note* 1.—It is to be noted that this guinea-pig may have been, to some extent, immune against plague, inasmuch as he was an animal which had survived an epidemic of plague which had occurred among the guinea-pigs in another laboratory.

26,386. You have further made some experiments on the longevity of the bacillus in grain and gunny bags?—I made the following series of experiments:—

I took two pieces of gunny bag and two samples of wheat. I placed each of these in a separate test tube and sterilized them and labelled them respectively tubes 1, 2, 3, and 4. I then thoroughly moistened the contents of these four tubes with a broth emulsion of a plague culture on agar. The contents of the tubes were then allowed to become air dry by placing them in an incubator.

Two days afterwards I introduced some sterile broth into tube 1 (one of the tubes which contained grain), and shook it up after allowing it to remain in contact with the grain for a little time. A portion of the washings of grain which were thus obtained were introduced into an agar tube. The rest of the washings were injected into *guinea-pig No.* 1. This guinea-pig remained well.

At same time some of the grain from tube No. 2 was introduced into a tube of sterile broth.

At same time a piece of gunny bag from tube No. 3 was treated in the same way as the contents of tube No. 1. A portion of the washings of the gunny bag was introduced into an agar tube. The rest of the washings were injected into *guinea-pig No.* 2. The guinea-pig remained well.

At the same time a portion of gunny bag from tube No. 4 was introduced into a tube of sterile broth.

Two days after I had performed the above operations, both of the agar tubes (*i.e.* the agar tubes which had been inoculated respectively with the washings of the grain and with the washings of the gunny bag) showed three or four colonies of bacilli, which had the microscopical appearance of plague bacilli. At the same time both the broth tubes (*i.e.* the broth tubes which had been inoculated respectively with a portion of dried grain from tube No. 2 with a portion of dried gunny bag from tube No. 4) showed a growth.

I inoculated 1 c.c. of the broth, into which the dried grain had been introduced into *guinea-pig No.* 3. Further, I inoculated 1 c.c. of the broth, into which the dried gunny bag had been introduced into *guinea-pig No.* 4. Two days after the *guinea-pig No.* 4 *died.* Plague bacilli were recovered from its spleen and liver. On the next day, *guinea-pig No.* 3 *died.* Plague bacilli were recovered from spleen, liver, and peritoneal fluid.

In view of the above results a further portion of the grain and a further portion of the gunny bag which had been infected with plague seven days previously were introduced into two further sterile broth tubes.

Two days after this 1 c.c. of the contents of each of these broth tubes was introduced respectively into *guinea-pigs* 5 *and* 6.

Guinea-pig No. 5 (*i.e.*, the guinea-pig into which the broth culture which was derived from the gunny bag was injected) died three days after he had been inoculated. There was evidence of considerable local reaction, but plague bacilli were recovered from spleen and liver.

Guinea-pig No. 6 (*i.e.*, the guinea-pig into which the broth culture which was derived from the grain was injected) showed slight local reaction three days after he had been inoculated. This guinea-pig developed no further symptoms.

In view of the result which was obtained with guinea-pig No. 5, a further portion of the gunny bag was planted out into sterile broth 12 days after it had been infected with plague.

This broth was cultivated for three days, 1 c.c. of the broth was then introduced into *guinea-pig No.* 7. The guinea-pig remained perfectly well.

It has thus been possible to recover the plague bacillus by continued inoculations from infected grain up to the third but not so late as the seventh day. In the case of the infected gunny bag it has been possible to recover the bacillus up to the seventh day, but not as late as the twelfth day after infection.

26,387. You made some experiments as to the growth of plague bacilli in an atmosphere of hydrogen?—Yes. The plague bacillus was grown in broth in an atmosphere of hydrogen gas. The growth was not rapid, and it did not differ much from the growth in broth exposed to air. In view of the fact that the plague bacillus appeared thus to be a facultative anaerobe an attempt was made to obtain the plague bacillus from earth floors of three infected houses by making, first, a cultivation in hydrogen and afterwards a cultivation in air.

Sources of the earth:—

I. Collected on 8th February 1899, from 25, Bori Street, one fatal case of plague had occurred in the house.

II. Collected on 8th February 1899, from hut in Victoria Bandar, fatal case of plague had occurred in the house on 8th February 1899.

III. Collected on 8th February 1899, from hut in Victoria Bandar, a plague case was sent to hospital from the hut on 8th February 1899.

Small quantities of the earth were mixed with broth and a portion of this broth (about ½ c.c.) was added to sterile broth. Hydrogen gas was then passed through the broth and the tubes sealed. A control broth culture of pure plague was at the same time made in hydrogen, and when this tube showed a distinct growth (36 hours later) the tubes in which the earth organisms were being cultivated were planted out in three dilutions on agar plates. These were examined from time to time during four days for any colonies resembling plague; any such were examined microscopically always with negative results. A similar series of experiments were done with the same samples of earth which had been and were artificially infected with plague bacilli. Not even under these circumstances could the plague bacillus be isolated from the earth by this method.

26,388. The whole series has been purely negative? Yes.

26,389. You have endeavoured to find the bacillus in the urine of plague patients?—Yes. The urine of 50 plague patients was examined bacteriologically, and the plague bacillus was isolated in two cases only. The

method of collecting the urine is open to some criticism. It was accomplished in the following manner:—The patient was made to pass water, and after a small quantity had been passed, a little was collected in a sterile tube. This urine was allowed to stand for a few hours till the mucus, &c. sank to the bottom of the tube. With a sterile pipette a small quantity (about ½ c.c.) of the urine from the surface of the deposit at the bottom of the tube was withdrawn and planted on agar. In only one case was the urine thus obtained found to be sterile. Almost always a rapidly growing micro-coccus was found. Occasionally other bacteria were found. Any colonies which at all resembled plague colonies were examined, and when a bacillus microscopically resembling plague was found it was isolated and grown in pure culture. Some of the pure culture then was inoculated into a rat, and the micro-organisms were again recovered from the dead animal. In only two cases was the plague bacillus thus found, viz., in cases Nos. 65 and 280, Mahratta Hospital. In the latter case, 280, a sample of the blood obtained from the finger at the same time as the urine gave a very abundant growth of the plague bacillus.

26,390. Can you give us some information as to the stage of illness when it was taken, and also how long before death?—Yes.

Case No. 65 was admitted into the Mahratta Hospital on 6th of January with right axillary bubo. His urine was obtained on the 12th, five and a half hours before death.

Case No. 280 was admitted into the Mahratta Hospital on 18th January 1899, with right femoral bubo. His urine was obtained on the 19th, four hours before death. The blood from the finger, taken at the same time, gave an abundant growth of plague.

26,391. What was the result of your experiments with regard to fæces?—I have tried four cases by plate cultivation and by successive strokes on agar tubes, three tubes being used; but in no case was I able to get the plague bacillus. The great difficulty was the rapidly growing contaminating micro-organisms.

26,392. Perhaps, in this instance, you will also state the period of illness?—Yes.

Case 226.—Bubo left inguinal. Admitted 16th January 1899; sample taken on 17th; died on 18th.

Case 284.—Right central bubo, Admitted 18th; sample taken on 18th; died on 19th.

Case 437.—Left axillary bubo. Admitted 24th January; sample taken on 25th. This patient recovered.

Case 530.—Left femoral bubo. Admitted 27th January; sample taken on 28th. Patient died on 30th January 1899.

26,393. You have examined the sweat in several cases?—Yes, and I never discovered plague bacillus.

26,394. Were they fatal cases?—I could not say.

26,395. Can you tell us the period of illness?—I am afraid I cannot give you that information.

26,396. You have also examined buboes, I think?—Yes. One bubo was examined by hypodermic needle; a small quantity of lymph withdrawn and planted on agar. This patient was recovering at the time of operation; his temperature being normal. Several colonies of staphylococcus albus developed, and a small diplococcus, but no plague bacilli. Another bubo was examined when opened, the patient still suffering from fever, and died some days later. A pure growth of plague bacillus was obtained from this case.

26,397. Was the bubo opened during the time of operation?—It was being opened. The discharge from another bubo, which had been opened some days, was examined, but no plague bacilli were found.

26,398. Have you ever found bacilli in a bubo?—Yes; on the one occasion which I have mentioned.

26,399. You have also examined the blood?—Yes. I have examined the blood from the finger on several occasions. I have no notes of the exact number of patients which I examined, but I frequently found the plague bacillus in the blood. It was from this source that we got nearly all our plague cultures.

26,400. Can you tell us the longest period before death when you found the bacillus?—The longest period that I ever found the plague bacillus in the blood before death was 51 hours.

26,401. I suppose you also found it at the moment of death?—Yes. I examined one case about one hour after death, and found the bacilli abundant in the veins.

26,402. What is your opinion as to the value of microscopic examination alone in detecting the plague bacillus?—It cannot be relied upon at all alone. The detection of plague by the microscope alone is exceedingly hard, indeed impossible. I have seen many bacteria, which, microscopically, look very like plague, and which, on more critical examination, as by rate of growth, character of colonies, and inoculation experiments on animals, have proved not to be plague. The size of the plague bacillus varies considerably, both in different growths and as regards the individuals in the same growth. A quickly growing plague bacillus on artificial media is, as a rule, a small bacillus, while a larger variety is a more slowly growing one. The individual members of a growth frequently vary from an almost coccus-like form to long thread-like individuals. Similar involution forms may be found in animals, but very rarely, the individuals are much more uniform in size, and, as a rule, stouter than the original growth on agar; bi-polar staining, too, is much better marked.

26,403. Have you any observation with regard to the persistence of plague after the death of animals?—With regard to the persistence of the plague bacillus after death, it is difficult to make sure that an animal has died of plague when decomposition has set in. Several such animals have been examined, and frequently a large thick spore-bearing bacillus has been found in all the organs and in the blood which apparently obscures or in some way destroys the plague bacilli. With a view to ascertaining whether any change occurred in an animal which was known originally to contain many plague bacilli the following experiment was made. A guinea-pig, which died of plague, was first examined shortly after death. Many plague bacilli were found in all the organs, bubo, and heart's blood. Other examinations were made two hours, six hours, and 26 hours after death, with the result that, despite the fact of the presence of many contaminating bacteria, the plague bacilli were abundantly evident even after 26 hours.

26,404. Were the bacilli dead or living?—I did not make cultivations.

26,405. What media have you used to cultivate the plague bacillus?—Various media were tried for the cultivation of the plague bacillus. An almost neutral agar or broth was found most suitable for ordinary use. The bacillus grew well, too, on glycerinated agar, but not well on glucose agar. Boiled white of egg did not make a good media, although the bacillus did grow slowly, forming peculiar involution forms with squarer ends than usual and many long forms. Sterile plantain was also tried, but the growth was not good or characteristic. The addition of varying proportions of anti-plague serum (Roux) to bouillon was tried. Those tubes in which the largest proportion of serum was present seemed to grow slightly faster. The serum of convalescent patients had no restraining influence on the growth of plague. Roux' serum on the surface of agar formed an excellent medium in which to grow the plague bacillus.

26,406. What do you infer from that fact with regard to the bactericidal property?—I infer that Roux' serum and the serum of convalescent patients outside the body has no bactericidal properties on the plague bacillus.

26,407. Have you paid some attention to the pathological appearances in the several animals on which you made experiments?—Yes, on rats. Little, generally, could be learnt as to whether a rat had died of plague by external examination. Buboes, although found on one or two occasions, were very rare. Inguinal axillary and parotid bubees were seen. As a rule, no indications were evident to point to the path of infection. The liver and spleen are always enlarged, soft, and friable. Frequently, no enlarged lymph glands in any situation could be detected. Microscopically, plague bacilli could be found in the heart's blood, often very few in number, but abundantly found in the liver, and particularly in the spleen. Pure cultures of plague bacillus were easily obtained from these situations. Buboes in which suppuration had taken place very rarely gave a growth of plague.

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26,408. They did sometimes?—A cultivation was obtained on one occasion.

26,409. Usually, you did not get it?—That holds true when suppuration has occurred. The *post-mortem* appearances found in guinea-pigs varied much more than in rats. Certain guinea-pigs showed a considerable degree of resistance. This resistance was seen in three different sets of animals. It was seen (1) in animals which had been vaccinated by the sediment in Haffkine's prophylactic; (2) in animals which had been injected with Roux' serum; (3) in animals which had survived an epidemic of plague which broke out among the animals kept in a shed in M. Haffkine's laboratory compound.

A non-resistant guinea-pig died of plague in from two to five days after hypodermic inoculation. There was, as a rule, little reaction at the seat of inoculation. A small bubo was generally found on the same side as the point of inoculation. The liver and spleen were enlarged, soft, and friable; hæmorrhages were frequently found, subcutaneously, near the seat of inoculation, and subperitoneally; also and perhaps most frequently around the kidneys. Frequently, also, some subserous punctiform hæmorrhages were found along the alimentary tract. Plague bacilli were abundantly found in liver and spleen and bubo, also at the seat of inoculation, less numerous in heart's blood. Peritonitis was found on two or three occasions showing microscopically an abundant and pure growth of plague.

A more resistant guinea-pig took longer to die, often more than five days. There was marked reaction at the seat of inoculation, a hard mass being felt which might cover an area of from one to two square inches. Buboes were larger, often more numerous than in rats. Suppuration was usual at seat of inoculation, occasionally also in the buboes. The spleen was enlarged and contained small tubercular greyish yellow hard nodules. Bacilli were abundantly found in these nodules, particularly at the periphery of the nodules for the centre of the nodule was degenerated or necrosed and did not stain well. Although the pulp of the spleen contained bacilli, their numbers were not so great as in the nodules. This was evident both by microscopical examination and by cultures on agar, a more abundant growth being obtained from a nodule than from the spleen pulp. The nodules varied in size from small just visible points giving a mottled look to the spleen (under these circumstances they were very numerous) to larger nodules from one-sixteenth to one-eighth inch in diameter, the nodules were then much fewer. Still more resistant guinea-pigs (and when I speak of these I refer particularly to those which received from one to two c.c. of Roux' serum at the time of inoculation with plague) showed very marked reaction at the seat of inoculation, which was generally the side of the abdominal wall. The infiltrated area often extended across the middle line and buboes were found in both axillæ and both groins. The buboes were largest on the side of inoculation; pure cultures of plague were obtained from all the buboes. The lungs showed small hard fibrous looking nodules which varied in size from one-eighth to one-quarter inch in diameter. The portions of lung tissue not occupied by the nodules were dark coloured and resembled the appearance seen in hypostatic pneumonia. Very little healthy lung tissue was left. In one case there was pleural effusion (hæmorrhagic) on one side. The spleen and liver were not much enlarged if at all, no nodules were noted in the spleen. Growths were abundantly obtained from the buboes and nodules in the lung, but not from the rest of the lung tissue. No growth was obtained from the liver, and on two occasions one colony from the spleen only. Microscopic specimens showed plague bacilli abundant in buboes and in the nodules in the lungs, but not in the lung tissue or other parts. The arrangement of the bacilli into little clumps in the lungs and spleen was very marked. Agar growths from these guinea-pigs gave many very long filamentous forms. Phagocytosis was frequently noted. On one occasion it was very marked in a guinea-pig, which had previously been vaccinated against plague, and which some time after received a large dose of living plague. In another case it was noted in the peritoneal exudation of a guinea-pig which had died of plague in the epidemic which broke out among the animals at M. Haffkine's laboratory. Another case of interesting phagocytosis was seen in the liver of a human fœtus. The mother aborted and died. An hour later, a pure growth of plague bacilli was obtained from some blood which was drawn from the basilic vein after death. A mixed growth containing plague bacilli was obtained from the vaginal discharge. The umbilical cord, liver, and spleen of the fœtus was examined microscopically; only in the liver were any plague bacilli seen, and these were all found phagocytosed in large mononuclear cells. Unfortunately no growths were made from the organs of the fœtus, as it had been placed in some rum to preserve it before it reached me.

26,410. (*Dr. Ruffer.*) Did you sterilise grain before you added the plague culture?—Yes.

26,411. Did you make any experiments on non-sterilised grain?—I am making them now. I have not finished.

26,412. How do you find the presence of bacilli in grain? Do you test it by cultures?—By placing the grain in broth and then planting out an agar and also examining the broth.

26,413. Do you test it in any other way?—I am making a second series of experiments. I am inoculating animals.

26,414. Have you had any results?—Not yet.

26,415. Have you been able to produce plague from the cultures obtained from the grain?—No.

26,416. In the case of gunny bags, how did you inoculate them; did you steep them in plague cultures?—No. I poured a few drops all over the surface of the gunny bags from a sterilized pipette.

26,417. Of the broth culture?—Yes.

26,418. It would contain more food than rat's urine, for instance?—Yes, and probably more bacilli also.

26,419. Did you test the presence of this bacillus in the gunny bags by inoculation?—I have not done so yet, I am doing that now.

26,420. So far as you have gone you have not been able to reproduce the disease from gunny bags?—No.

26,421. Did you test it by making plates from gunny bags?—No.

26,422. How do you test for the presence of the bacillus after 48 hours?—A portion of infected gunny bag was placed in the broth and any growth which formed was examined.

26,423. Did you examine it microscopically?—Yes; and then planted it on agar in a tube.

26,424. You found no plague bacilli?—That is so.

26,425. Did you ever inoculate the broth which you got from gunny bags afterwards?—No.

26,426. Did you ever find the plague bacillus in the blood of plague patients who recovered?—Never.

26,427. You said just now that you have been able to grow the plague bacillus on a sterilized plantain?—Yes.

26,428. Does it grow well on a sterilized plantain?—I did not find it grow well.

26,429. Does it grow?—Yes.

26,430. So that you can get the growth of plague by purely a vegetable medium?—Yes.

26,431. In the case where you found plague bacillus in an open bubo, had that been opened artificially, or had it burst?—It had been opened artificially.

26,432. (*Prof. Wright.*) Will you, with a view to further testing whether any toxine passes out from the plague bacilli into the nutrient medium, test the respective toxicity, firstly of your peptone broth, and secondly of the filtrate from a plague culture which has been grown in that peptone broth. Further, will you determine whether that filtrate becomes less toxic when it is heated to 60° or 100° C. respectively?—(Witness afterwards submitted the following statement):—

A peptonised broth was made and sterilised in the usual manner.

This was divided into two portions.

Portion 1 was placed on one side to be used to determine the toxicity of the culture medium.

Portion 2 was inoculated with plague and was cultivated for three weeks.

After that time the broth was filtered off from the bacilli, the filtrate was found to be sterile.

It was then divided into three portions, Portion A., Portion B., and Portion C.

Portion A. was employed for determining the toxicity of the unaltered filtrate.

Portion B. was heated to 60° C. for one hour in order to determine the toxicity of the filtrate after heating to 60°.

Portion C. was heated to 100° C. for five minutes in order to determine the toxicity of the boiled filtrate.

The result of the experiments which were made were as follows :—

TABLE IV.

RELATIVE TOXICITY of PEPTONE BROTH and of the HEATED and UNHEATED FILTRATE from a PLAGUE CULTURE which had been GROWN on that MEDIUM for THREE WEEKS.

Number* of Guinea-pig.	Amount and kind of Fluid which was injected.	Result.
Guinea-pig No. 1	Original peptone broth, 10 c.c.	Survived.
„ „ 2	Original peptone broth, 20 c.c.	do.
„ „ 3	Original peptone broth, 30 c.c.	do.
„ „ 4	Unheated filtrate from plague culture, 10 c.c.	do.
„ „ 5	Unheated filtrate from plague culture, 20 c.c.	Died in 24 hours.
„ „ 6	Unheated filtrate from plague culture, 30 c.c.	Died in 36 hours.
„ „ 7	Filtrate from plague culture heated to 60° C, 20 c.c.	Died in 30 hours.
„ „ 8	Filtrate from plague culture heated to 60° C, 30 c.c.	Died in 24 hours.
„ „ 9	Filtrate from plague culture heated to 100° C., 20 c.c.	Very ill 36 hours after. (*Note* 1.)
„ „ 10	Filtrate from plague culture heated to 100° C., 30 c.c.	Died in 24 hours.

Note 1.—No further report as to the result of the experiment has since been received.

* The guinea pigs in the experiment varied between 350 and 400 grammes in weight.

A soluble toxine appears thus to be developed when the plague bacilli is cultivated in peptone broth.

Further, it would appear that the soluble toxine is unaffected by heating to 60° for one hour and by heating to 100° C. for five minutes.

26,433. Will you kindly further make experiments to determine the respective toxicity of (*a*) normal horse serum, (*b*) Galeotti's anti-plague serum, and (*c*) Roux' anti-plague serum ?—Yes. (Witness afterwards submitted the following statement of results) :—

TABLE V.

RELATIVE TOXICITY of NORMAL HORSE SERUM, of ROUX' ANTI-PLAGUE SERUM, and of GALEOTTI'S ANTI-PLAGUE SERUM.

Number of Guinea-pig.	Amount and Kind of Serum injected.	Result.
Number 1	Normal horse serum, 20 c.c.	Survived.
„ 2	Normal horse serum, 30 c.c.	do.
„ 3	Roux' anti-plague serum, 20 c.c.	do.
„ 4	Roux' anti-plague serum, 30 c.c.	do.
„ 5	Galeotti's anti-plague serum, 20 c.c.	do.
„ 6	Galeotti's anti-plague serum, 30 c.c.	do.

Nothing in the general condition of these animals suggested that there was any difference in toxicity between these various sera.

26,434. Further, will you kindly determine in the case of the guinea-pigs which you employed for the experiments which are tabulated in Table II., whether the injection of the filtrate (uncarbolized) from Mr. Haffkine's prophylactic confers on guinea-pigs any greater protection against plague than the original nutrient medium which he employs ?—Yes. (Witness afterwards submitted the following statement) :—

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TABLE VI.

RESPECTIVE IMMUNIZING POWER of HAFFKINE'S ORIGINAL NUTRIENT MEDIUM and of the FILTRATE (i.e., of the FILTRATE obtained from a CULTURE of PLAGUE which had been GROWN in HAFFKINE'S NUTRIENT MEDIUM) from HAFFKINE'S PROPHYLACTIC.

Number of Guinea-pigs.	Amount and Kind of Fluid which had been previously injected.	Date of the Test Inoculation with living Plague-Bacilli.	Interval which elapsed between the previous Inoculation and the Test Inoculation.	Result.
No. 1 (Control.)	Nil	5.4.99.		Died in 24 hours.
No. 2 (No. 1 of Table II.)	Haffkine's original nutrient medium, 30 c.c.	„	18 days	Died in 2 days.
No. 3 (No. 2 of Table II.)	Haffkine's original nutrient medium, 20 c.c.	„	„	Died in 4 days.
No. 4 (No. 3 of Table II.)	Haffkine's original nutrient medium, 10 c.c.	„	„	Died in 1 day.
No. 5 (No. 4 of Table II.)	Haffkine's original nutrient medium, 5 c.c.	„	„	„
No. 6 (No. 5 of Table II.)	Uncarbolised filtrate from Haffkine's prophylactic, 30 c.c.	„	„	Died in 3 days.
No. 7 (No. 6 of Table II.)	Uncarbolised filtrate from Haffkine's prophylactic, 20 c.c.	„	„	„
No. 8 (No. 8 of Table II.)	Uncarbolised filtrate from Haffkine's prophylactic, 5 c.c.	„	„	Died in 1 day.

If we take the three guinea-pigs, Nos. 6, 7, and 8 (*vide* above table), who received the filtrate from Haffkine's prophylactic, and if we compare them with the three guinea-pigs, Nos. 2, 3, and 5, who received comparable quantities of Haffkine's original nutrient medium, and if we add up the number of days which these two sets of guinea-pigs survived after the plague inoculation, it will be obvious that the protection which we afforded by the original nutrient medium is neither less nor greater than the protection which was afforded by the filtrate from Haffkine's prophylactic.

26,434A. Will you kindly further make some experiments on disinfection with a view to determining the efficacy or otherwise of the methods of disinfection which are applied to plague houses in Bombay? Further, in making experiments on the subject, will you take as your test of the efficacy of all these disinfection processes, not the presence, or, as the case may be, the absence, of the plague bacillus, after the completion of the disinfection (for you have no satisfactory means of ascertaining that presence or absence), nor yet the destruction or non-destruction of a certain number of non-pathogenic bacteria in those houses. But will you, instead of either of these tests, take as your test of the effectiveness of a disinfection process the destruction, or, as the case may be, the non-destruction of all bacteria, except such as may prove themselves to be more resistant to disinfectants than the plague bacillus ? — Yes. (Witness afterwards submitted the following statement) :—

EXPERIMENTS ON DISINFECTION.

Eight disinfected rooms were examined generally, as shortly after disinfection as permitted the drying of the antiseptic on the floors. All the houses examined had pucka floors, *i.e.*, cement or stone floors.

The disinfected houses were all in the Mandvi district, and had been disinfected with a solution of perchloride of mercury, supposed to be of the strength of 1 in 500.

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The method of obtaining the cultures was as follows:—

The cotton wool plug was removed with antiseptic precautions, from an empty sterile test-tube, the inner end of the plug was rubbed over a considerable area of the floor, about one square foot, some dust and dirt was thus collected on the wool plug, which was again inserted into the sterile tube. In the laboratory a portion of the soiled wool was introduced into two broth tubes. These were placed in the incubator. Of the eight samples of dirt examined by this method one was found sterile. Three others were sterile except for the presence of a mycelial fungus. The specimens from the four other floors gave bacterial growths; these were planted out on agar plates, and the various bacilli found were isolated and grown in broth. In all, four varieties of bacteria were found. These were one micro-coccus, and three species of bacilli. The resistance of each of these bacteria was tested by an exposure for 15 minutes to the following dilutions of perchoride of mercury solution. The resistance was compared with the resistance of the plague bacillus when exposed for the same time to the same dilutions of perchloride solution.

The strengths of perchloride of mercury solutions were—

1 in 1,000.
1 in 2,000.
1 in 5,000.
1 in 10,000.
1 in 20,000.

It was found that in all cases the surviving organisms of the disinfected floors were less readily killed than the plague bacillus when tested by the above solutions.

The method of testing the resistance of the bacteria was as follows:—

All the bacteria were obtained in pure culture in broth. By a capillary pipette, a small quantity of the broth growth was placed in the sterile perchloride solutions of the above-mentioned strengths, and left for 15 minutes. After that time, with another sterile pipette, a small quantity was withdrawn from the bottom of the perchloride solution where the broth growth had sunk as a flocculent precipitate, and this was placed in a fresh broth tube.

The bacteria which were found survived 15 minutes' exposure in all dilutions of perchloride, even 1 in 1,000, except one bacillus, a small thin bacillus, producing yellow pigments. This last only survived a strength less than 1 in 2,000. Plague bacilli tested in a similar manner never survived 15 minutes' exposure to a strength of 1 in 5,000. In one series of experiments the plague bacillus did not survive exposure for 15 minutes to a solution of 1 in 10,000. It would thus appear that the bacteria which were obtained from these disinfected floors were in all cases more resistant to the action of perchloride than the plague bacillus.

26,434B. Will you further endeavour to ascertain whether the plague bacillus can, when it has been added to unsterilized earth, be recovered from it by making cultivation in CO_2?—Yes. (Witness afterwards submitted the following statement):—

Two series of experiments were done in this connection:—

A sample of ordinary garden earth was obtained, to this a considerable quantity of living plague germs was added. Some of the infected earth was emulsified in broth, and a portion of this emulsion was added to six broth tubes prepared for anærobic growths. The six tubes were divided into three series, two being treated to saturation with CO_2, two were treated to almost saturation, two were treated with just an excess of CO_2. They were incubated for three days. After this interval a control broth tube in which plague was growing in saturated CO_2 showed a distinct growth. Agar plates in three dilutions were then made and examined after two days, and again, after three days, but no bacillus conforming to all the tests for plague was found, although in two samples a bacillus, morphologically resembling plague, was found. The last-mentioned bacillus when grown on agar, in pure growth, grew more rapidly than plague. Further, when a portion of this growth was emulsified in broth and was inoculated in considerable dose into the peritoneal cavity of mice, the inoculated animals survived.

These anærobic tubes, when opened, had all a very strong smell, apparently of sulphuretted hydrogen.

The effect of H_2S gas by itself and the effect of a mixture of H_2S and CO_2 on plague growth was therefore investigated. Another series of six tubes was inoculated with freely infected garden earth.

In the present undiluted H_2S plague did not appear to grow, although a muddiness resulted in the broth from the deposition of sulphur from the H_2S.

In a mixture of CO_2 and H_2S there was slight growth. H_2S was first passed in, then CO_2, so that while the atmosphere in the sealed tube contained little of H_2S, some of this gas, probably, remained dissolved in the broth. The growth of plague occurred in chains, as it does in ordinary CO_2 broth cultures.

The six tubes which are in question were incubated for three days. They were then planted out on agar plates in three dilutions. These plates were examined daily for three days; I did not succeed in detecting bacilli that answered to all the tests of plague.

This is hardly to be wondered at, for agar plates of plague grow very slowly, whereas the bacteria found in the earth grow very rapidly, by the end of three days nearly all the plates were covered by other growths than plague.

26,434C. Lastly, will you determine whether the virulence of the plague bacillus can be increased by making a series of passages through guinea-pigs by the method which was successfully employed by Mr. Haffkine in exalting the virulence of the cholera bacillus?—Yes. (Witness afterwards submitted the following statement):—

I have to report that I have performed five series of inoculations with a view to testing the possibility of increasing the virulence of the plague bacillus by making a series of intra-peritoneal passages through guinea-pigs.

The method which was adopted was the following:—

A pure culture of plague was obtained and emulsified in broth. A few minims of this broth emulsion were inoculated with aseptic precautions into a guinea-pig's peritoneum. The aseptic precautions referred to were (*a*) the use of a sterile capillary pipette, (*b*) burning a small area in the abdomen of the guinea-pig with red hot glass rod, and (*c*) the careful introduction within that area of the filled capillary pipette. After death a *post-mortem* was made with aseptic precautions. The peritoneal exudation was removed by a capillary pipette. It was then introduced into a test tube which was placed in a slanting position in the incubator. It was allowed to remain there for 24 hours, when a few minims of the purulent exudation were inoculated into the second guinea-pig. When this guinea-pig died the same procedure was adopted with a series of successive guinea-pigs. The exudation was always examined microscopically before it was introduced into a healthy guinea-pig. When the fluid was found to be contaminated it was rejected. The purity of the peritoneal fluid was also controlled by cultivation.

Five series of guinea-pigs were inoculated in the manner which has just been described.

In each case the virulence was found to be increased.

The following is the longest series of inoculations which was successfully carried out:—

Guinea-pig No. 1.—Inoculated intraperitoneally with a 15 days old agar cultivation of plague (source from which the culture was derived was not noted). *Died in 5 days.*

Peritoneal fluid removed and incubated for 24 hours.

Guinea-pig No. 2.—Inoculated with a few drops of above peritoneal fluid. *Died in 52 hours.*

Peritoneal fluid withdrawn after death was incubated for 24 hours.

Guinea-pig No. 3.—Inoculated intraperitoneally with a few drops of above peritoneal fluid. *Died in 24 hours.*

Peritoneal fluid withdrawn after death and incubated for 24 hours.

Guinea-pig No. 4.—Inoculated intraperitoneally with a few drops of the above peritoneal fluid. *Died in 24 hours.*

Peritoneal fluid found to be contaminated by a thick long bacillus.

It will thus be seen that by the above method the virulence of the plague bacillus for guinea-pigs can be very rapidly increased.

In other series of experiments a degree of virulence was obtained, such that when two or three drops of the exudation were introduced intraperitoneally the guinea-pigs died some time during the night.

(Witness withdrew.)

(Adjourned till to-morrow.)

At The Secretariat, Bombay.

SEVENTIETH DAY.

Wednesday, 22nd March, 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).

MR. J. P. HEWETT.
PROF. A. E. WRIGHT, M.D.
MR. A. CUMINE.
DR. M. A. RUFFER.

MR. C. J. HALLIFAX (*Secretary*).

Surgeon-General R. HARVEY, I.M.S., recalled and further examined.

Surg.-Gen. R. Harvey, I.M.S.

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26,435. (*The President.*) I understand that you have been making detailed inquiries with regard to inoculation in the Khoja community in Bombay; are you prepared to make a statement of the result of your inquiry to this Commission?—Yes, I am prepared to make a statement, but I am afraid that I cannot as yet give you any results. I find that the inquiry is a very much larger and longer one than I have had time to undertake. I have been hard at work ever since I got to Bombay and I have only touched the fringe of the subject. I have not been able to draw any inferences or conclusions or to get any definite information to enable me to draw such; for instance, we found that it is extremely difficult to ascertain the cause of death in the case of all the people who have been seen by medical men. We have taken the names and addresses of these medical men, and we intend to write to each individual so as to endeavour and get accurately the cause of death. We found the Jamaat books, the records of the Khoja community, are exceedingly accurate as regards the great majority of details, but they are extremely inaccurate with reference to the cause of death because a very large number of people are not seen by medical men and anything they are told is put down as the cause of death. Some of the entries are absolutely ridiculous. You find headache, you find asthma in a child of two years, and consumption in children of two years, and all sorts of impossible things of that kind. The inquiry, therefore, will take a very considerable time; but it is going to be continued, and the results will eventually be communicated. I estimate that it will take several weeks before they can get anything definite. I find that the original investigation of Professor Haffkine was one which involved an enormous amount of energy and thought. Although it is a very short report,* the amount of work involved in preparing it was enormous. I think that the records of the community are kept in a much more full and proper way than those of any average people; and therefore we ought to be able to get something definite out of them. At the same time you must remember that this is a community of from 10,000 to 13,000 persons spread about in the middle of a large city; so that it is not at all easy to follow the individuals; the results, therefore, will probably not be scientifically accurate. It will, however, enable us to form conclusions which are in the main correct; but they will not have the same value as those obtained under proper conditions from a smaller community. Several points have come out in addition to the fact that the records are correct. One is that the community as a whole have a most extraordinary belief in the efficacy of inoculation, though probably half of them do not accept it; there is a large number who have told me that the reason why they have not been inoculated was that they preferred to leave it to God,—that they were in God's hands, and that they thought it was not right to interfere with his decrees. So that a very large number of them, although they do not object to it and have nothing urge against it, do not actually accept it. I think it will probably be found that about half of the community are inoculated, and that half of them are not inoculated. We know, I should think, with practical accuracy from the Jamaat books those who have been inoculated and those who have not, so that we can get a very fair index as to the mortality among the two classes. Of course the difficulty is to get the actual cause of death. Another point is this. I have been asking them whether they know of any evil results arising from inoculation. Some of them have said that they heard it produced impotence and leprosy after variable times, but none of them have been able to tell me anything beyond hearsay evidence. None of them had had any experience of evil resulting from it. Most people think so little of it that a great many of them have been inoculated and re-inoculated three, four and five times. I was in hopes that one result of the investigation would be to give some indication as to the length of the protection afforded by the prophylactic. But in consequence of these constant re-inoculations, it will be extremely difficult and probably impossible to get any definite information with regard to it.

26,436. That was the main object of your inquiries?—Yes, and I am afraid they have been frustrated by the eagerness of the people to be inoculated over and over again.

26,437. Does any other point suggest itself to you which you wish to mention?—I do not think so.

26,438. Have you anything to say as to the selection of inoculated persons?—I think that in inoculations there is always a process of unconscious selection. Inoculations are performed mainly on those who come up for inoculation. People who are weak or who are sickly in any way do not come up. I have found repeated instances during the last few days of families in which the only person who has died (I have only been investigating the families in which death has occurred) has been the only uninoculated member of the family. On making inquiries as to why the individual had not been inoculated when all the other members of the family had been inoculated, I was told that the medical officers thought the individual was not fit for it or that he himself did not like to be inoculated because he was sick or old. The consequence of that has been that a considerable number of people, who ought by rights to be among the inoculated, because all the members of their families are inoculated, have died without being inoculated and have gone to swell the tale of the deaths among the uninoculated. I think that is the explanation. It brings the results of Prof. Haffkine's inquiries into the Khoja community out of the region of impossibility and makes his inferences much more likely to be true. The rates worked out in that inquiry seemed to me to be impossible. The deaths from all other causes than plague in the inoculated work out to only 3·33 per thousand per annum. That seemed to me to be an impossible death-rate in a community which included children and old people. I thought there must be some fallacy about it. I think that is the explanation with regard to it—that a considerable number of people who ought really to have been, and would have been inoculated if they had not been unwell, were included in the uninoculated, and went to swell the death-rate among them.

* *See* App. No. IV. in Vol. I. of these Proceedings.

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26,439. Did you find any evidence of age selection?—In that report a considerable number of children and old people had been inoculated, but the number of inoculated was not nearly in proportion to the numbers in the population, and therefore Prof. Haffkine left out of calculation among the uninoculated children and old people.

26,440. (*Prof. Wright.*) Have you seen any facts which would lead you to suppose that the plague prophylactic confers protection against any other diseases?—At first I was very much staggered by that statement, because although one knows that the revulsive effect of one disease occasionally drives out another, it is not a common occurrence, and I certainly do not think it could account for the enormous difference in the death rate between the inoculated and uninoculated; but I find that Prof. Haffkine has been going (it is not a random assertion) on a large number of instances where people have believed—I do not say rightly or wrongly—that the effect of inoculation has been to stop other diseases from which they have been suffering for a long time. I think the effect can only be small, but it may possibly have occurred in a certain number of cases.

26,441. It is not forced upon you by statistical evidence which you have collected?—Not by statistical evidence.

26,442. When you compare the mortality among those inoculated Khojas, what will you take as your control? Will you take the mortality among the uninoculated members of the same family, or will you take the mortality among the other Khoja families who have not been inoculated at all, or will you take the total mortality of Bombay?—I think the fairest way would be take the mean mortality of the Khoja community.

(Witness withdrew.)

Mons. W. M. HAFFKINE, C.I.E., recalled and further examined.

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26,443. (*The President.*) Referring to the evidence you gave us when you appeared before the Commission on a previous occasion, I find that you undertook, if possible, to supplement the information you gave us with regard to one or two subjects. You told us that you had some exact data relative to the animals which had been treated with serum, which you thought you would be able to put in afterwards (*see* Question No. 133)?—The materials regarding the treatment of plague by serum of immunized animals could, unfortunately, not be analysed and put in order, owing to pressure of work.

26,444. (*Prof. Wright.*) I believe that before you proceeded to inoculate against plague you did a series of inoculations against cholera?—Yes.

26,445. Certain inoculations against cholera had been previously done by Dr. Ferran in Spain?—Yes.

26,446. In what respect is your method of cholera inoculation an improvement on that of Dr. Ferran?—I have little information as to how Dr. Ferran did his inoculations against cholera. A large part of the publications he made at the time were in Spanish and I am not acquainted with them. My information as to the manner in which he did his inoculations comes from the inquiry of the French Government Commission, deputed during the cholera epidemic in Spain to investigate Dr. Ferran's operations. Their report has been embodied in a paper by Prof. Brouardel, President of the Commission, and Dean of the Medical Faculty in Paris, but I am not aware whether Dr. Ferran put at the disposal of the Commission the details of the method he employed.

26,447. I was under the impression that the faults which you find in Ferran's system were that he used vaccine which was not sterile, that he used a culture which was of unknown virulence, and that he did not employ a standardised vaccine. Is that so?—The fixing of the strength of the vaccine is an extremely important point in all inoculations, though the urgency of that procedure differs with regard to different microbes and different vaccines, living and dead ones.

26,448. I am asking you with regard to cholera inoculation. I understand that your improvement on Ferran is that you used a perfectly sterile vaccine, and a vaccine the strength of which was actually known to you. Is that so?—Yes.

26,449. You think these two points—of employing a perfectly sterile vaccine and of employing a vaccine in definitely known doses—are the most important points in every vaccination. Is not that so?—Yes; they are exceedingly important.

26,450. How far have you been able to carry out, in the plague inoculations, these principles which you carried out so successfully in the cholera inoculation?—In the case of cholera, the method employed for having the vaccine of a fixed strength consists in keeping the pathogenic properties of the microbes at a given height by passages through animals. It is known that very great variation takes place in the power of the cholera microbes in causing the disease. When one compares cholera cultures of different origins, one finds a variation in the proportion of about 1 to 100; that is, the amount which is necessary for killing an animal by cholera may vary from 1 given quantity of virus to 100.

26,451. In the case of plague, have you taken any steps similar to those which you took in the case of cholera to ensure that your vaccines were made with a microbe of known virulence?—No, not systematically. The operations were conducted in a place where plague existed, and we were, in the majority of cases, getting for our cultures microbes from patients, thus obviating only the variations occurring in the laboratory. Apart from our knowing that it was a microbe which had produced a fatal effect upon men, we did not fix further its virulence.

26,452. Do you think you can assume that a microbe which is taken from a plague patient is always more virulent?—No; but we sterilized the vaccine, and measured the dose.

26,453. You say in your evidence that the virulence of the plague microbe can be easily kept up by passages through animals; have you made those passages through animals?—Yes; but we were unable to do so regularly. In the inoculation against cholera we pass the vaccine through guinea-pigs daily. So far as we can get guinea-pigs, the rule is that every day fresh specimens of microbes should be taken from a new animal. The work, however, always suffers from our not being able to do so regularly.

26,454. Would it be possible to do that in the case of plague?—I was not able to do so.

26,455. Would it be possible to do so if you had time at your disposal?—Yes; not only is it possible, but, as stated, in a large number of cases we do so. In the preparation of our vaccine we employed, whenever possible, microbes passed through rats and monkeys.

26,456. We may take it from you that it has not been possible to do it always, but that, theoretically, it would be possible if you had time enough at your disposal?—Yes, it is so.

26,457. You say that the virulence of the plague microbe is kept up by passages through animals; will you kindly specify the animals?—The microbes that we used were passed through rats and monkeys. At one time a number of experiments were done in the laboratory on monkeys, and the virus was transferred from monkey to monkey for other purposes, not specially for the inoculation against plague. Those microbes acquired a virulence higher than that which they had in the beginning.

26,458. Did you find the virulence to increase when you made passages through monkeys?—Yes.

26,459. Did you find the virulence increased when you made passages through rats?—Yes.

26,460. Did you find that to hold true invariably? We had it in evidence yesterday that, in the three series of experiments which were done in the Plague Commission laboratory here, the microbes died out instead of becoming more virulent?—In our case we employed only microbes that showed themselves virulent. In the experiments which were conducted in the laboratory we had specimens of microbes which, at the beginning, were less effective, and which, after they had been passed through five, six, or a dozen animals, acquired an increased virulence.

26,461. Do you think that it is feasible to obtain virulent cultures by this means?—Yes; not, however, by passing the microbe through monkeys.

26,462. Through what animals?—Most probably rats; it may require special precautions to maintain the power of the microbe if interruption of the series occurs.

26,463. Similar to those you took in the case of cholera?—Yes, precisely.

26,464. (*Dr. Ruffer.*) Have you been able to do that in rats yet?—Yes. As I stated, I did not do that continuously, but we had microbes passed through series of rats, and which maintained a high degree of virulence. But I never had sufficient leisure for that myself, and I never had an officer who could be put on that special task of daily passing microbes through animals so as to have the microbes always passed freshly through a rat or a monkey, or any other animal which we might select finally.

26,465. (*Prof. Wright.*) In addition to laying down that a microbe of a fixed and known virulence ought to be employed in making vaccines, you also lay down that a fixed quantity of microbes ought to be employed?—Yes.

26,466. How far have you been able to carry that out so as to estimate what quantity of microbes were contained in the doses which you prescribed?—In the inoculations against plague I never relied upon the measurement of the dose itself. At the time when I gave my previous evidence I said that we always relied upon the effect which the vaccine produced upon men. Our estimate as to the doses necessary for inoculation were always obtained from the reaction observed in inoculated people.

26,467. We have had it in the evidence of Dr. Milne that you hold up your bottles to the light so as to judge the opacity, and that in conformity with this you write the doses on your bottles?—That is so. The cultivation flasks do not grow uniformly. In a 100 flasks prepared from materials obtained on the same day, passed through the same processes, and inseminated with the same microbes, there will be a variation, and often a very considerable one, in the crops obtained. In this case there is an unequal degree of modification produced in the medium also. For determining the dose one has, therefore, to take into additional account the abundance of the growth also.

26,468. You do estimate the dose by holding up the bottle to the light and by judging of its opacity?—Yes.

26,469. Do you think that is a good method of judging the number of bacteria present?—It is possible that this is the most practical method.

26,470. Do you think it is a good method?—Yes.

26,471. Do you think it is a satisfactory method?—I have to estimate to what extent the method is satisfactory by the results produced.

26,472. We had it in evidence yesterday that a series of weighings of the sediment contained in individual doses brought out the fact that some of your doses contain between seven and eight times more sediment than others; in view of these weighings, do you think that your method is a satisfactory one?—Not in view of that, but in view of the results obtained from estimating the febrile reaction and comparing the richness of growth, it was satisfactory.

26,473. Is that a satisfactory method of standardizing?—I do not believe that the weighing of the sediment is a satisfactory method.

26,474. I asked you whether, in view of the results that were obtained by weighing, you think that one can arrive at a good estimate of the amount of sediment by holding the bottle up to the light?—I do not believe that, by weighing the growth, or otherwise estimating the sediment alone, you will obtain a satisfactory method of standardizing, and I never had recourse to that method. When I say I hold up the bottle to estimate the abundance of the growth I do not mean that that is the only circumstance which I take into account. I estimate the doses by inoculation in men and by observing the reaction produced.

26,475. I understand that method of standardization, but I do not understand whether you think it is a good method of standardizing, to judge the quantity of microbes by holding the bottle up to the light and noting the opacity?—I do not say that that is the only method I employ.

26,476. But you do consider that that method is satisfactory?—No.

26,477. We had it in evidence from Dr. Milne that the dose put on the bottle was judged by holding the bottle up to the light?—We shall not be able to analyse the matter satisfactorily unless what I say is taken into account fully. I stated that we estimated the required dose by the effect produced upon man. I must repeat that, when I have a batch of 500 flasks inoculated at one time on one day, or, say, in the course of three days, with the same cultivation of microbes, and I find that it produces the required amount of fever when injected in a dose of 2½ c.c., I still watch the abundance of the growth which takes place in the different flasks, and that abundance of growth is judged by inspecting the flasks and comparing the density of their growth. If, therefore, you wanted to standardize the vaccine simply by weighing the amount of sediment, it is most probable that you would never have any definite results.

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26,478. That is not suggested to you. I asked you whether it is a good way of estimating the quantity of sediment to judge the opacity by holding the bottle up to the light?—It is a sufficient method of estimating when you compare additionally the result of inoculation in men.

26,479. Do you mean that your results on man are so constant that your method of standardizing must be perfect?—In all the inoculations which were done experimentally, under conditions deliberately chosen for testing the efficacy of inoculation, we obtained a fixity of results which probably is unequalled by any other series of experiments of the kind. In my evidence on the former occasion I enumerated the observations which we made in attacked communities. You noticed how little the protection afforded by inoculation varied. As long as it was so I consider the method selected as satisfactory, being at the same time adapted to the conditions of our practice.

26,480. (*The President.*) The question is not settled. We have not gone into the point as to whether the proofs you gave of the efficacy were, to our mind, satisfactory or not; you must not assume that?—In selecting my method I had, however, to judge by my results. In continuing to apply the method of estimating the doses which I followed, I had to watch the effect produced, and as long as the results answered my expectations I was justified in employing what I found to be practicable under the circumstances of our work.

26,481. (*Prof. Wright.*) I asked you if you were shaken in your impression that your method of standardization is a satisfactory method by the fact that sometimes the sediment is eight times larger than in other cases?—Not in the least; this most probably referred to microbes of different strength.

26,482. You said you have not tested the virulence of the microbes?—No; I tested the strength of the vaccine, not by the virulence of the microbes when injected alive into animals, but by the effect which the prophylactic produced on men, as is done by the vaccine lymph for small-pox.

26,483. We have been informed that, in a great number of cases, the vaccine was not tested on men in the laboratory before it was sent out; therefore, it was in those cases tested only by this opacity of the fluid, and if that is shown to be a defective method, I ask you whether it is not true that sometimes the standardization of the vaccine was insufficient?—The method was tested on men whenever it was possible. We made the best of the existing conditions.

26,484. I am speaking apart from the question of what was feasible. I ask you, as a mere scientific fact, whether the vaccine was always correctly standardized, and whether you would recommend this method of holding the bottle up to the light as an effectual method of standardization?—As long as we have no other practical method we have to follow this.

26,485. That means it is not a good method, because it follows that you must be looking for a better one; is that so?—I do not think that any attempts to find a better method will be successful as long as the inoculations themselves continue. (Note by witness on correcting proof of his evidence:—The answer in this form has no sense, and contains surely a mistake of the reporter. It should be as follows: "I do not think that our attempts to find better methods will ever cease as long as the inoculations themselves continue.") I never maintained that the methods we employed were all that I could desire.

26,486. (*Dr. Ruffer.*) What you mean is that you are satisfied there is no better method at present?—I, personally, had no better method applicable at the time.

26,487. (*Prof. Wright.*) A further question arises as to the sterility of the vaccine; have you anything to

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say on this matter? We have had it in evidence that a good number of bottles were found to be contaminated. Do you think these contaminations are important, that is, did they affect the vaccine prejudicially?—These contaminations are a most undesirable factor, but I knew that the conditions of our work were not such as to permit of completely avoiding that factor. I was satisfied, however, that these contaminations, under the conditions under which they were likely to occur, were not a source of danger. They were mainly undesirable as endangering the efficacy of the prophylactic, and we took all possible precautions to avoid them. Our conditions of work, however, were not such as to secure this object fully. We continued to employ the means at our command because of the urgency of the time, and because I knew that the amount of risk which we ran was unimportant.

26,488. And you have come to the conclusion, with regard to the basis of your previous cholera inoculations, that it is not as necessary as you then thought it to be to employ a microbe of known virulence, and have absolutely aseptic vaccine? You think that certain divergencies from that rule may be permitted in the case of plague?—It is certain that even in plague, where we use dead vaccines, better results will be obtained if the above basis is strictly adhered to.

26,489. It has been suggested that an effect is produced upon gonorrhœa by injections of the prophylactic; do you know anything about that?—Not from personal observation. I had a verbal report from the medical officer, Captain Thomson, who made a series of observations to that effect, but have no personal knowledge on the subject.

26,490. Do you know what effect was produced by the injections?—No. I have no details. I understood that he was going to put this information before the Plague Commission.

26,491. (*Dr. Ruffer.*) I understood you to say that you had some experiments showing that there was some relation between the effect on man and the opacity in the bottle; can you put in those experiments?—Yes.

26,492. I suppose you have notes of those experiments, have you not?—We have notes in the shape of the reports of the inoculated people.

26,493. Can you add these notes to your evidence?—I would have to select them, but I will state at once what kind of information we have. The amount of growth which you obtain in a cultivation flask in one week is less than what you obtain in two, three, or four weeks. If you inoculate to-day a given number of flasks, and use some of them in a fortnight, while the others are permitted to stay on longer, there is a larger quantity of growth in the latter. The same dose inoculated from those different flasks gives a different reaction; the inoculation from the flasks which have been left to grow longer, and have a greater opacity, produces a higher reaction.

26,494. You are still of opinion that the fever is really the standard of the efficacy of the inoculation?—In the series of experimental inoculations, which was the basis of our work, we used that standard as an indication of the effectiveness of the material.

26,495. You stated, in the evidence which you gave before us three or four months ago, that you had a method by which a non-carbolized bottle could not possibly get into circulation. If you will remember, I asked you how you were sure that the bottle which had not been sterilized could not by mistake get into general circulation, and be used on patients, and you said that you had an elaborate method by which you could prevent that with certainty?—I did not mean a method, but we had arrangements made in the laboratory which would secure that.

26,496. Will you tell us these arrangements?—They have been enumerated in the rules for sterilization, which I have supplied to the Commission; since then we have introduced a controlling procedure which consists in the syphoning officers inoculating an agar tube with a sample from each flask.

26,497. To show the sterility?—Yes.

26,498. Have you any evidence to show that the prophylactic inoculation has any effect on leprosy?—No.

26,499. Or epilepsy?—No, I have no personal information on this point.

26,500. With regard to the statistical results of your inoculations, I have noticed in several places that the mortality from all causes, not from plague, among the inoculated is very much smaller than among the uninoculated; I think you found that out yourself, and put it in your* statistics of the Khoja community in Bombay. It was the same with the Khoja community in Karachi, and in the various communities which were inoculated in the State of Baroda. Have you any explanation of that fact?—In my Khoja* report I enumerated three or four circumstances which all probably took part in producing that result. One factor which influences the difference to a great extent has been mentioned by the Director-General of the Indian Medical Service in his evidence this morning. In a central station where people are inoculated as they come there is an unconscious selection, by weak individuals abstaining from inoculation. This tends to produce a difference in the general mortality, when one compares afterwards the inoculated and the uninoculated groups. This factor did not exist in the inoculations such as we have done in Undhera or in the Umdrkhadi Common Jail, where all the inmates agreed to be inoculated, but where the authorities only permitted a half of them to be done. In the instance of Umdrkhadi all the prisoners were paraded in 9 or 10 rows, and every second individual was inoculated. In the Undhera village we inoculated again a population agreeing to be inoculated in a body; the committee appointed to carry out the inoculations deliberately inoculated only half the members of each family, having their attention directed to making the groups of inoculated and uninoculated as comparable as possible. In these cases the unconscious selection is eliminated. Whereas at an inoculation station one will observe that a certain number of weaker individuals abstain from inoculation, mothers do not bring up very small babies, or old people do not come to be inoculated. This, however, is only one factor. Another is this. The mortality from general causes is generally low in the whole population during a period immediately following a severe outbreak, a large number of susceptible individuals having been killed off during the preceding period. It is certain that a number of deaths that are referred to general causes amongst the uninoculated are really deaths from plague, preventable by a specific treatment. This circumstance certainly renders the comparison comparison between the inoculated and uninoculated far less paradoxical than it looks at first. The last factor to be mentioned is the possibility of the inoculation against plague, or most probably inoculation of any pathogenic microbes, influencing also the course of diseases due to other infections.

26,501. I will put the question in another form. In Karachi there were 1,200 Khojas inoculated?—Yes, I believe, about that.

26,502. At Karachi we had the figures given to us of these 1,200 Khojas, and I find that not a single one had died from general causes in six months; do you think the explanation which you have given us just now is sufficient to account for that?—I am not able to estimate the extent to which it is applicable to that case.

26,503. You have no personal knowledge of the statistics of Karachi?—No. Moreover, in enumerating the three factors above mentioned, I am unable, and it is probably impossible, to estimate to what extent they are at work in each individual case. In the inoculations among the Khojas here in Bombay the observations referred to a period below four months, following a year when the mortality in that community has been just double the usual one, that is, it referred to a relatively short period following a severe epidemic. The mortality from general causes amongst the inoculated was exceedingly small, and I am able to take upon myself the responsibility of stating that no more deaths than those reported after my personal minute of inquiry occurred in that community. That is a circumstance which the Director-General, I believe, has now satisfied himself about completely in his present investigation. But even here I cannot distribute the result among the different factors that have effected it.

26,504. (*Prof. Wright.*) Do you think the presence of the supernatant fluid in the prophylactic is essential?—I have no information upon which to modify my views on the subject.

26,505. Upon what experimental evidence did you base the opinion that the supernatant fluid had an

* See App. No. IV., Vol. I. of these Proceedings.

important influence in conferring protection?—That was a circumstance which, in my first evidence, I asked permission not to discuss. I should like to avoid the consideration of my plan of work from a general or theoretical point of view.

26,506. I am not asking you from a theoretical point of view; I am asking if you have made any experiments which support that opinion?—I cannot support it except by the consideration of the results actually obtained.

26,507. (*The President.*) Have you any experimental data?—The results as observed on men are the only ones. I introduced the supernatant fluid in the hope of reducing the fatality of attacks in inoculated.

26,508. (*Prof. Wright.*) But you have never tried to inoculate some men with the sediment alone and others with the liquid alone?—No, not yet. In a letter, No. 260*a*,* which I addressed to the Government nine months ago, I sketched out a plan by which this could be ascertained, but I was unable to carry it out yet

26,509. When you judge by the intensity of the fever produced by the inoculation in cases where you inoculated as large a quantity as 15 c.c., do you not think the peptone contained in the prophylactic itself might account for some of the fever?—The experiments were not made in these conditions. We have the best febrile reaction with small doses of prophylactic.

26,510. In the particular case where you inject a large quantity, do you think there is that possibility?—Yes, but when we inject large doses it is because we observe little fever.

26,511. Have you made any experiments upon men with peptone?—No. One of the officers in my laboratory, Dr. Mayr, is to make those experiments, but they have not been made yet.

26,512. As far as your present information goes, you would object to eliminate the supernatant fluid?—I would decidedly.

26,513. On *à priori* grounds?—Yes.

26,514. But for no other reasons?—As long as no other treatment has been shown to be as effective as the one employed, it is inadmissible to modify it. All alterations must be justified by results actually obtained.

26,515. If experiments were brought before you showing that no protection was afforded to animals by the supernatant fluid in your prophylactic, if, for instance, the filtrate from your prophylactic proved to be no more toxic to animals than the original nutrient medium which is employed as a culture medium for those plague bacilli, would you then think there was a reason for eliminating the supernatant fluid from your injections?—I would not dare to eliminate it in the treatment of human communities until restricted observations, as mentioned in my letter to Government, would show that admissible.

26,516. But you have no experimental evidence to show that it is useful. If you had experimental evidence of animals to show that it was useless, would you still persist in using it on men?—I would not adopt a modification in the general practice until exact observations on men showed such a modification to be admissible.

26,517. Pending observations on men, if the experimental evidence of animals seemed to show that the supernatant fluid conferred no benefits on animals, would you still approve of employing the filtrate on men?—Yes.

26,518. Why?—When you try the effect of the treatment on animals under special conditions you may fail to detect in the whole of the prophylactic fluid any elements justifying its application to men. Such was the case with the experiments carried out in London, in St. Bartholomew's Hospital, in an attempt to immunize guinea pigs against the plague. *A fortiori*, when you examine the material, not as a whole, but from one particular standpoint, and fail to detect reasons for a particular component of the prophylactic, that would not make me less diffident to adopt the conclusion based on your experiment. In the inoculation against cholera, many experienced investigators, after prolonged and careful experiments on animals, came to an absolutely negative result as to the efficacy of the method, whereas the inoculation in men proved to themselves and to others the striking efficacy of the method.

26,519. In your experiments with regard to cholera inoculations you were instigated to do your experiments on men because the experiments on animals had proved successful?—Yes, and with regard to the inoculations against the plague that was the case also.

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26,520. If experiments, often repeated on different animals, showed that the supernatant fluid conferred no protection, and was not more toxic than the original nutrient fluid, would you then abandon it?—No. At the present stage of our work I would admit only a guarded attempt on an isolated group of men, and restricted experiments made and repeated with regard to that particular point.

26,521. Do you prefer to do your experiments on men to doing them on animals?—For establishing final results, for proving a method completely, it is impossible to rely upon any other experiments than experiments made directly on the species of animals which is expected to benefit by them.

26,522. But if all experiments on animals showed that the thing was noxious, or no use, would you still recommend it for men?—I would first distinguish between useless and noxious. It is, however, evident that if I myself had made a series of experiments on animals and found a method useless, I would have no inducement to try it upon men.

26,523. Pending the information, obtained from results of animals, that the supernatant fluid is of benefit, why do you still say it should be used on men?—That brought us unfortunately to a kind of discussion which I was trying so much to avoid, viz., as to what extent my considerations were sufficiently sound to induce me to apply the method I devised. I stated in my first evidence, that in acting as I did I made use of all my previous experience and knowledge, and might have been as easily mistaken as be in the right. It so happened that the method I employed answered entirely, in all particulars, to my expectations. I had, therefore, up to now, no reason to be shaken in my reasoning, but should like to avoid discussions on this point.

26,524. You think that your own opinion, independently of any backing up by experiments on animals, is sufficient for you to use the supernatant fluid?—I have backed up my opinion by the results on men.

26,525. Are the grounds you refer to, to be found in your experiments, or are they to be found in your imagination?—Mr. President, I beg your kind permission to withdraw now from this discussion.

26,526. (*Dr. Ruffer.*) Have you any facts, from experiments made on animals, in connection with plague, to show that the supernatant fluid is of use in producing immunity?—No, not on animals, and I should add, such experiments are impossible.

26,527. (*The President.*) I think you said you still believe that the pyrexia was a good gauge of the preventing influence of a preventive such as the fluid you have been using?—Yes.

26,528. You think that the pyrexia as distinguished from the quantity of the preventive substance which you have introduced is really a true indication, or a true reason, of the protection?—It seems to be a satisfactory practical guide in using the plague prophylactic.

26,529. Is it a question of fever or a question of the introduction of a certain quantity of antidote, or is the fever a mere unavoidable accident because it is an effect which that thing will always produce?—I have no grounds for believing that the immunity is produced by that rise of temperature, I mean I have no grounds for determining the actual part which the rise of temperature plays in producing the final resistance. But I have adopted the rise of temperature as an indication of the activity of the vaccine; and this indication guided us satisfactorily in our operations. In the inoculations where we observed that the prophylactic failed to produce a sufficient febrile reaction the results were lower. On the other hand, whenever we had a prophylactic which, when injected in moderate quantities, produced a high degree of fever, the results were more satisfactory. It is on that account that we accepted and followed the above indication. In the first experiments in the Mufassil, in Lanauli, and in Kirki, I had a material which I had to inject in increased doses in order to obtain any marked degree of fever. I had finally to content myself with a lower temperature, and the results were less satisfactory. In Kirki for instance, where the difference in the mortality between the inoculated and the uninoculated was only 77·9 per cent., I had a material which failed to produce a sufficient febrile reaction when injected even at a dose of 10 c.c.

26,530. You have no idea of how much of any special chemical substance was present in the fluid?—No.

26,531. (*Prof. Wright.*) Have you any special knowledge of the results in Kirki? We were told in

* *See* App. No. LXXXII. in this Volume.

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Poona that the records in Kirki were kept so badly that nothing could be made out of them. Did you have a special report?—I have not embodied my observations in a special report, but I have all the information and documents to show that the statement which has been made to you in Poona is incorrect. I have in my laboratory all the papers referring to the composition of the families and all particulars as to the occurrences of plague in the inoculated and the uninoculated.

26,532. There must then be two reports, one inaccurate, which was the one which Col. Fawcett was speaking about, and another, an accurate one, which you have. Has your report been communicated to the Commission?—The results have.*

26,533. I understand there was a report kept of results in Kirki locally, and that that report on examination was found to be absolutely unreliable. In addition to that it was suggested that you must have had a special report made to you by a special reporting officer?—I was myself on the spot and collected the information personally with two assistants.

26,534. Have you communicated that information to us?—I have communicated the final results, the number of the inoculated and uninoculated, and the occurrences of plague among them. But the documents which I have in my laboratory have not yet been embodied in a report like that made out with regard to the Daman or Undhera outbreaks.

26,535. Your figures were based on personal inquiries?—I was in Kirki during nearly the whole of the epidemic, and was visiting the infected barracks and the Plague Hospital twice a day; and all the information I have is in my own handwriting, or in that of the assistants who were with me.

(Witness subsequently put in certain statements A., B., and C., regarding Lanauli, Kirki, and Undhera, which are published below; and he also put in a statement which, at his desire, is published as Appendix No. LXXXIII. *in* this Volume).

A.

OCCURRENCES of PLAGUE in G. and D. Wards of LANAULI, (put together), between the 24th July, 1897, and the end of September, 1897.

Date.	Number of uninoculated present.	Attacks.	Deaths.	Number of inoculated present.	Attacks.	Deaths
24.7.97 -	711	4	4	45	—	—
25.7.97 -	686	5	5	116	—	—
26 7.97 -	621	4	3	126	—	—
27.7.97 -	568	2	2	175	—	—
28.7.97 -	544	3	3	197	—	—
29.7.97 -	472	2	1	266	—	—
30.7.97 -	460	6	4	276	—	—
31.7.97 -	436	3	2	300	1	1
1.8.97 -	398	8	6	328	3	2
2.8.97 -	373	8	6	342	3	1
3.8.97 -	341	1	1	363	1	—
4.8.97 -	336	3	2*	336	1	—
5.8.97 -	331	1	—	368	1	—
6.8.97 -	329	3	1	367	—	—
8.8.97 -	323	1	—	370	—	—
9.8.97 -	322	1	1	370	—	—
10.8.97 -	320	1	—	371	1	—
11.8.97 -	319	1	1	370	—	—
12.8.97 -	318	1	—	370	1	1
13.8.97 -	316	1	1	370	—	—
14.8.97 -	315	1	—	370	—	—
17.8.97 -	314	1	—	370	—	—
19.8.97 -	313	1	1	370	1	1
20.8.97 -	312	1	—	369	—	—
22.8.97 -	311	6	5	369	—	—
23.8.97 -	305	—	—	369	1	1
26.8.97 -	305	1	1	368	—	—
3.9.97 -	304	1	1	368	—	—

* *See* Questions No. 68, and 69, of these Proceedings.

Date.	Number of uninoculated present.	Attacks.	Deaths.	Number of inoculated present.	Attacks.	Deaths.
4.9.97 -	303	1	—	368	—	—
6.9.97 -	302	1	1	368	—	—
7.9.97 -	301	3	3	368	—	—
13.9.97 -	298	1	1	368	—	—
23.9.97 -	297	1	1	368	—	—
Total -	—	78	57	—	14	7
Average daily strength.	377	—	—	323	—	—

Calculating upon the death rate among the uninoculated, the inoculated inhabitants of C. and D. Wards of Lanauli should have had 49 deaths instead of 7, which is a difference of 85·7 per cent.

B.

OCCURRENCES of PLAGUE in the FOLLOWERS of the FOUR BATTERIES at KIRKI (put together), between the 16th August, 1897, and the end of September, 1897.

Date.	Number of uninoculated present.	Attacks.	Deaths.	Number of inoculated present.	Attacks.	Deaths.
16-17.8.97	1,542	11	10	98	—	—
17-18.8.97	1,307	4	4	322	—	—
18-19.8.97	1,268	2	1	357	1	1
19-20.8.97	1,239	6	4	383	—	—
20-21.8.97	1,105	7	7	511	1	1
21-22.8.97	1,074	5	5	534	2	—
22-23.8.97	1,047	3	3	554	2	1
23-24.8.97	1,044	9	7	552	5	3
24-25.8.97	926	6	4	656	—	—
25-26.8.97	827	6	6	749	3	2
26-27.8.97	812	3	1	755	4	3
27-28.8.97	809	5	3	751	2	1
28-29.8.97	804	4	2	749	—	—
29-30.8.97	800	3	3	749	1	1
30-31.8.97	797	2	1	748	1	1
31.8-1.9.97	795	11	6	747	1	1
1-2.9.97 -	784	9	4	746	1	1
2-3.9.97 -	775	3	2	745	1	—
3-4.9.97 -	772	3	2	744	—	—
4-5.9.97 -	769	5	3	744	1	—
5-6.9.97 -	764	6	3	743	2	—
6-7.9.97 -	758	3	3	741	—	—
7-8.9.97 -	755	1	—	741	1	—
8-9.9.97 -	754	4	2	740	—	—
9-10.9.97 -	750	1	1	740	—	—
10-11.9.97	749	1	—	740	1	—
11-12.9.97	748	3	2	739	—	—
12-13.9.97	745	1	1	739	—	—
13-14.9.97	744	4	3	739	1	1
14-15.9.97	740	1	—	738	—	—
15-16.9.97	739	2	—	738	—	—
16-17.9.97	737	2	2	738	—	—
17-18.9.97	735	1	1	738	—	—
19-20.9.97	734	1	—	738	1	—
20-21.9.97	733	2	—	737	—	—
23-24.9.97	731	1	1	737	—	—
25-26.9.97	730	1	1	737	—	—
28-29.9.97	729	1	—	737	—	—
Total -	—	143	98	—	32	17
Average daily strength.	859	—	—	671	—	—

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C. (i.)

COMPARATIVE ANALYSIS of the 28 FAMILIES of UNDHERA, where CASES of PLAGUE have occurred, from the date of INOCULATION on the 12th February, 1898, up to end of March, 1898.

Caste.	Inoculated.		Uninoculated.	
	Total.	Deaths.	Total.	Deaths.
Hindus:—				
Carpenter - -	1	—	1	1
Pattidar - -	30	1	27	7
Baria - -	16	2.	16	8
Patan wadia -	4	—	3	3
Khalpa - -	4	—	4	1
Sweeper - -	6	—	4	2
Dher - -	10	—	9	4
Total - -	71	3	64	26

C. (ii.)

CLASSIFIED according to AGES.

Ages.	Inoculated.		Uninoculated.	
	Total.	Deaths.	Total.	Deaths.
Under or of 5 years -	13	1	10	3
Over 5 and under 60 years.	56	2	53	22
Over 60 years - -	2	—	1	1
Total -	71	3	64	26

C. (iii.)

CLASSIFIED according to SEXES.

	Inoculated.		Uninoculated.	
	Total.	Deaths.	Total.	Deaths.
Male - - -	41	3	24	7
Female - -	30	—	40	19
Total - -	71	3	64	26

(Witness withdrew.)

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The Hon. Sir ANDREW WINGATE, K.C.S., K.C.I.E., recalled and further examined.

26,536. (*The President.*) I understand that you are prepared to continue some statements with regard to plague which you favoured us with up to a certain date when we last had the pleasure of seeing you. Will you kindly continue those statements?—When last I had the honour of appearing before the Commission, I was asked if I would prepare some maps showing the results of plague infection. The points in these district maps I now put in,* to which I would invite attention, are as follows:—The date of the first case in each of the three epidemics is given under each village. The three epidemics are distinguished by colours; the first is shown in red, the second in blue, and the third in green. This map (*pointing on map*) being of the Dharwar district, the infected villages are all in green. If you take the total plague recorded deaths up to the week ending the 3rd of March 1899, you will see that they are 94,000 approximately.

26,537. Is that in the Bombay Presidency?—Yes, in the Bombay Presidency. Those are the figures from the published weekly list. During the current year in the Belgaum and Dharwar districts, there have been 17,000 and 30,000 plague deaths respectively up to the end of the same week, the 3rd of March; that is 47,000 deaths in those two districts, which is half of 94,000, the total plague mortality of the Presidency, including Bombay City. One-half of the mortality up to date in the current year has thus occurred in these two practically newly infected districts. That seems to indicate, as compared with the 61,000 recorded plague deaths of the previous year ending May 1898, that, over the very large area of the Presidency generally, the present epidemic has been of a more restricted character—I cannot use the term milder where the percentage of deaths to cases continues so high. I should like to invite the attention of the Commission to a fact that they will see in nearly all the maps, that although, for example, there have been 30,000 deaths in the Dharwar district, these deaths are nearly all confined to this part of the district (*indicating on the map*). This localization is well emphasized in Hubli taluka. Hubli town is *here*. These green marks, as you will see, cluster round first, the town, and then the taluka, though, as you will see, a more distant village is here and there infected. The point is that the spread of infection appears to me to be the same in the country as you find it to be in a town, that is very localised at first, and spreading from a given centre. It is precisely the same if you extend your glance over the whole of India. The Bombay Presidency is the infected area, while the rest of India remains practically free. It is very striking. In every map you will see huge areas—highly populated areas—without a single case, or perhaps one or two only over a whole district. That seems to me to indicate that the outflow from an infected area is probably more dangerous close to the centre of infection than at any distance from it, that as the outflow gets further away from the centre, so the danger seems to lessen. Take the case of a man, starting from an infected house: if he goes 10 miles in two hours, he appears to be more dangerous than if he has gone 20 miles in four hours. Or it may be that the local spread of infection is due to entry into an infected area. It may be a market town which is infected, and where you have a market town the people from all the villages round go into the infected area: and, therefore, you get this localised infection. Into Ahmedabad or Broach the exodus from Bombay I presume has been as constant and as great in the past three successive years, but it is only this year that North Gujarat has been attacked. Take the town of Broach. You will find that it was not until Ankleshwar village, within 10 or 12 miles of Broach was attacked, that Broach was infected. That seems to me to point to the fact that the danger to Broach was not the incoming of people from infected areas at a distance, but either the outgoing of the people from Broach to an infected place within their easy reach, or the entry of people from a neighbouring infected village into Broach. You may say that the people of Broach went and came also to and from Bombay. That is so, but there you introduce two fresh elements—the one of distance and exposure to sun and air when going back to Broach, and the other of the medical inspection and the disinfecting arrangements, whether they involve detention or merely inspection. The people who go from Broach to Bombay by rail, and go back, come under those restrictions; and, therefore, are to a certain extent not so liable to introduce infection, as when the infected area approaches close to a town. And there is the further danger that it is by the people of the town visiting that infected area that plague is also carried. All I wish to point out is, that as the Commission will examine our maps they will almost invariably find that the infected places are grouped; that when they hear of a district with 30,000 deaths in it, and expect to find the

* Not printed with the Commission's Proceedings.

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whole district a mass of plague, it is nothing of the sort. The plague is absolutely localised in certain parts of the district. It is just the same when going into a plague infected town; you will be taken to one or two infected streets, and it is there where you have the chief mortality.

Turning now to the point that was aimed at last year, trying to detain the outgoing population of an infected place, I have a few figures which I brought with me which I should like to show you of the needlessness, after experience, of putting the people to a vast amount of inconvenience. Last year at 12 stations during a period of 5·14 months, 131,074 people were detained for periods varying from 5 to 10 days. Out of those 131,000 people, 201 cases of plague were detected, and nearly 131,000 people were disinfected. At 14 stations this year, during a period of 3·8 months—a shorter period—116,000 people have been disinfected, against 131,000 in the previous year; and 160,000 people haven been subjected to the clinical thermometer test. Out of these nearly 12,000 people have been detained on account of a rise of temperature, and 266 cases of plague have been detected. It is too soon to say what the results in the districts may be of the re-infection from Bombay. You cannot tell that until the next two months have expired. Up to date, at all events, the proportion of the exodus of the two years is not very dissimilar, and 266 cases of plague have been caught, against 201 in the previous year; and only some 12,000 people have been detained instead of 131,000. From what I know, I think that the medical examination has been still more thorough than the detention, and has probably led to fewer cases; I say fewer cases, because if you get a case into a camp, there have been a good many instances of cases after 9 days, 11 days, and 12 days, which seems to me to point to infection within the camp from one to another. On the other hand, by the use of the clinical thermometer, and the detention of all people who show the least temperature, 266 cases of plague have been detected, and apparently now the cases all develop in the first few days. These statistics seem to me to indicate that there is a very small amount of risk from the exodus of the population of an infected town under precautions for carefully medically examining the people. The major part of the exodus from Bombay has gone by sea. Our infected ports up to date this year have been two small places in the Kolaba district, and one, or perhaps now two, in the Ratnagiri district, comprising a very small number of cases of plague. These are considerations which seem to me to indicate that under proper precautions, plague is not a thing to terrify people who are at a safe distance, and who are not likely to go into the infected place itself.

26,538. Do I understand that you are of opinion that this railway examination is valuable?—Most valuable. It is not only valuable because of the cases which it detects, but it is probably still more valuable in preventing sick people from leaving the infected areas. If you look at the weekly list for the Thana district, where the restrictions this year were specially relaxed compared with the year before, you will see that there were 756 imported cases in the first year, and 163 imported cases last year, when there were detention camps; whereas this year the number has increased to 212 up to date. These figures are not confined to cases imported from Bombay, but indicate generally the variations in the number of cases imported from Bombay. In the Thana district, last year, there were less than 1,200 deaths, whereas this year there have already been over 3,000. The medical examination was purposely taken off between Bombay and one part of the Thana district, in order to give a certain amount of play to the Bombay population, and not to tie them up too tight. The medical examination acts in those two ways—that you catch the case that does go out, and you prevent from going out a great number of cases which would otherwise go out.

26,539. Do you think the great trouble involved is quite justified even by stopping 266 infected persons?—Do you mean trouble to the people?

26,540. Everyone; to the officers employed, and the people subjected to examination?—I do not think that there is much annoyance from a simple medical examination.

26,541. I do not mean annoyance—trouble or expense?—There is a certain amount of trouble, and there is a certain amount of expense; but if the examination were taken off, I think that the country would be flooded with plague cases immediately.

26,542. I quite expected you to say that, it is obvious?—I will prove it. Take the town of Hubli. How were all these places round the town infected? Had it been possible to have a medical examination, by the thermometer, of everyone going out of the town, and to detain everyone showing any excess temperature, the chances are that spread of plague would have been less in that part. The other danger, which I indicated to you, of people going into Hubli, would, perhaps, have remained. Persons who go into the infected house, or into the infected area, are susceptible, and may come out infected.

26,543. Have you anything to tell us about evacuation?—This map of the Dharwar district probably represents the state of things as they existed at the end of the rains. Perhaps another 50 or 60 infected villages have been added since; but had you seen the map at the end of the rains, it would practically have been something like it is now. The extent of infection represented makes it look like a hopeless task to anybody, unless you put in an army of people to deal with it. By simply putting in a few English officers—about 10 or 12—and working with the people, not doing anything by force, but working with the people on our side, the results I venture to think have been very remarkable. There was a percentage of deaths on the total infected population of 6·8 before evacuation, and after evacuation the percentage fell to 3·2. There were 17,000 odd deaths before evacuation, and there were a little over 7,000 after evacuation. If I had been able—but I regret to say I have not been able yet—to find out how many of the 7,000 deaths occurred in the first ten days after evacuation of each particular village, I have no doubt we could show our results in a far more striking light. Still, taking it broadly, there were 114 infected villages, with 17,467 deaths, up to the 11th of November 1898. I should like to show you this statement, showing the total plague mortality of the Dharwar district at the same time, as follows:—

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PLAGUE PROGRESS STATEMENT.

1.

For PERIOD previous to EVACUATION, *i.e.*, from 5th August to 11th November 1898.

1. Week ending	2. Total in District Indigenous. Cases.*	Deaths.*	3. Number of Villages infected Week by Week. Progressive Total.	New.	4. Total Number of Villages which had Indigenous Plague during Period stated.	5. Aggregate Population of Villages in Column 4.	6. Percentages. Total Cases and Deaths on Total Population. Cases.	Deaths.	Deaths on Cases.	7. Averages. Of Cases and Deaths per Village through Epidemic. Cases.	Deaths.
1898.											
August 5th	191	162	2†	1‡							
„ 12th	400	316	8	4							
„ 19th	809	671	13	5							
„ 26th	879	657	23	10							
September 2nd	765	589	25	2							
„ 9th	1,038	885	35	7							
„ 16th	1,642	1,300	39	4							
„ 23rd	1,083	916	46	10	115§	255,228	8·6	6·8	80·2	189	151
„ 30th	2,074	1,683	53	5							
October 7th	1,671	1,424	66	10							
„ 14th	1,539	1,237	76	20							
„ 21st	2,368	1,914	78	8							
„ 28th	2,286	1,397	84	11							
November 4th	2,128	1,558	91	5							
„ 11th	2,924	2,358	94	12							
Total	21,757	17,467	—	114							

For PERIOD EVACUATION progressing, *i.e.*, from 12th November to 2nd December 1898.

1898.											
November 18th	2,194	1,857	94	12							
„ 25th	2,344	1,876	97	6	23	36,896	4·8	4	82·9	78·1	65·3
December 2nd	1,846	1,562	100	5							
Total	6,384	5,295	—	23	Cases, 1,799	Deaths, 1,503					

For PERIOD subsequent to EVACUATION, *i.e.*, 2nd December 1898 to 3rd March 1899.

1898.											
December 9th	1,412	1,143	92	13							
„ 16th	1,200	1,035	98	13							
„ 23rd	1,241	1,061	111	13							
„ 30th	1,080	860	107	26							
1899.											
January 6th	806	682	94	12							
„ 13th	792	641	94	12	143	224,055	3·9	3·2	82·3	61	50·2
„ 20th	495	467	84	9							
„ 27th	285	238	81	7							
February 3rd	195	139	66	5							
„ 10th	360	255	59	10							
„ 17th	344	253	54	9							
„ 24th	292	235	46	7							
March 3rd	118	87	37	4							
„ 10th	104	89	44	3							
Total	8,724	7,185	—	143							

* The figures are taken from the daily reports.
† Hubli and Dhárwár.
‡ Dhárwár.
§ Hubli has been added to complete the total.

NOTE.—Villages in which the figures and facts are not reliable and those which had imported cases only are omitted.

You will see that from the middle of November, when evacuation began to take effect, the death rate immediately began to decline. After evacuation, there were 143 freshly infected villages (excluding the 114 I mentioned before), and there were 7,185 deaths after evacuation. That gives, previous to evacuation, an average of 151 plague deaths per village, and after evacuation, of 50 deaths per village. From the figures, you will see that the Dharwar district has declined from a weekly mortality of over 2,000 to a weekly mortality of about 74. This improvement has been gained, I think, almost without a single prosecution, without almost a complaint, and practically by the people themselves, under the guidance of a few

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officers. The evacuation of villages is now so well understood, that we are continually hearing of villages where a few dead rats have been discovered, and the villagers have, of their own accord, immediately vacated their village. They are continually vacating villages now, of their own free will. Therefore, I think, that in future the expenditure is capable of great reduction, because we shall be able to rely more and more upon the voluntary intelligent action of the people. The people are coming forward in a most splendid way, not only to bear the great death rate when it attacks a particular village, but in the way of self-help. I think, considering how very exposed they are to infection, and how very liable they are to take it, that the way the people are coming forward to carry out the measures which they are convinced are necessary is most creditable to them. Up country, I think I am right in saying that, in small towns and villages, particularly during the fair season, there need be very little difficulty in checking an epidemic. Infection was very quick here (*indicating on the plan*). It has thrown out a great deal of plague in various directions, but from the moment evacuation came in the spread of the disease has been checked. Evacuation acts in this way. First it checks the epidemic. If it is done early in the epidemic, it will check the epidemic absolutely; if it is done after an epidemic has become pretty severe, it will bring down the mortality very rapidly. Evacuation will therefore lessen mortality; and it will decrease the duration of the period. If information is got early, and evacuation is prompt, your epidemic may only last a few days, or a few weeks, and thus curtailed, the spread to new villages is arrested. The longer an epidemic lasts in any particular town, the greater the danger of the infection spreading. On the other hand, if you have turned out the population of the infected village to live in their fields, the villagers from villages all round do not visit the infected area, and there is no danger from visits to the evacuated population.

26,544. In the favourable figures which you give us, I suppose you include cases in which evacuation was carried out in circumstances which were not the best for the evacuation—where it was done late in the epidemic, and so on?—Yes. All villages are included. Evacuation was begun late because of the rains. It might very reasonably be said: "The epidemic has "stopped of itself; it is an accident that your evacua- "tion measures began in November, when the thing "was going out of itself; it is a declining epidemic." To that I would invite your attention to the figures in the Bijapur district, which is in all soil and climatic conditions very akin to parts of the Dharwar district which were infected, and where evacuation was able to begin immediately. If you compare the villages, they are few in the Bijapur district, though a certain number of new villages are always being attacked. If the mortality be compared, in the Bijapur district there are seldom more than 25 to 50 cases per village, frequently much less; whereas in the Dharwar district, during the rains, there are few villages which did not suffer severely. I will take one village of 1,280 people. There were 424 deaths—that is 33 per cent. of the population—was carried off. In another village of 4,222 souls, 922 persons died, or nearly 22 per cent. That just shows what plague can do if circumstances are such that the people cannot help themselves, nor can the Government help them. The problem now before us, I think, is solved, with regard to the method of dealing with plague up-country during the cold season—which is the dry season for up-country. I think plague is always capable of being controlled under these circumstances inexpensively and comparatively without compulsion or coercive methods which are very unadvisable to resort to. The problem still unsolved is: What are we to do in the next rains, when a town or village has been infected? Our experience up-country has been that the villages which have been attacked during the rains have mostly occasioned a great spread of infection. Take Igatpuri, Sirur, Belgaum, and Hubli; in every case the attack has been during the rains, and in every case the spread has been very serious. There is another point, perhaps, to consider, upon which I can offer no explanation, although it seems to me to be somewhat borne out by the maps, namely, the fact that in the Deccan the spread does not seem to be so rapid or violent as in the black soil districts of Satara, Kolhapur, Belgaum, and Dharwar. The seizures appear to be very rapid in those districts. There is no apparent reason why a town like Poona, or say Sirur, when attacked, should not have produced the ame tremendous spread as has been the case further south. There seems to be something which I cannot venture to explain. I only offer it as a fact which I have observed.

26,545. With regard to the black soil districts in the rainy weather, how do you propose to deal with an epidemic?—If evacuation is considered to be impracticable, the only thing that I think is feasible in the rains would be to prevent the population from leaving save under restriction. To confine a population has always appeared impossible, as being inhuman. But given inoculation, I think it would be quite feasible to say to the population—"You can be inoculated or you "can leave the town after temporary residence in a "camp or you may stay in the town." We might offer a protective prophylactic, but leave an open door under certain precautions. Probably medical examination by the clinical thermometer and disinfection of all articles of clothing and bedding would prove sufficient without temporary residence in a camp, and in any case the inoculated must be subjected to these precautions. Then it might be necessary to control the entry into the town, because although the residents may be all inoculated, it seems to me that the town itself may be infected. This surmise is due to what appears to be the difference between plague and every other disease, namely, that plague attacks animals, particularly the domestic creature, the rat. The rat in India runs at night about everybody's house and over and about the sleepers on the ground, and therefore although you may have an absolutely protected because inoculated population, yet if plague were imported into the town, and the rats caught the infection, it is quite possible that there might be a certain amount of local infection independent of people. To what extent that may be the case I am not prepared to say, but there is this fact which is very difficult to get over, and which all our officers have had experience of over and over again,—that when an evacuated population re-occupies the village site and the villagers open up and clean the houses (the rats naturally go into the roofs and other places), a certain number of plague cases sometimes result—perhaps very few—even after the population has been free from plague for weeks before they go back to their houses. That seems to be explainable, not by the fact that the whole place has remained infected—for if it had been, everyone would have got plague when they came back—but by the probability that, a day or two before, some diseased rat had infected the particular house in which the fresh plague case suddenly occurs. I do not think the infection lasts long. Localization of the disease appears to imply that the infection cannot be a permanent one, since it is rarely carried to a distance. I hope in the next two months the Dharwar district will be absolutely clear, because there are no big towns now infected. Therefore the situation there, I think, is a very hopeful one.

26,546. Have you arrived at any conclusion as to the maximum population of a town that might be evacuated under ordinary favourable average conditions?—I would not resort to total evacuation in any town—in which the people did not themselves desire it—in which the population was over, say, 50,000 or 60,000. I daresay evacuation could be done quite easily up to 100,000. Even in the case of a town of 50,000 or 60,000, I would hesitate if the people objected. Take an example of Broach, which has just been infected. The Collector there, with only partial evacuation, seems to be carrying the town through what would be a very severe epidemic, with a comparatively small mortality. I do not think there are more than 5 or 6 cases a day, whereas there ought to be 20 or 30 according to previous experience, and the time the epidemic has lasted. The mills are all working, and the trade but little interrupted, and everything is done with the goodwill of the people. There is no great spread of infection to the surrounding villages. I do not attach very great importance to a certain spread from the town, because from experience in Sholapur, or Admednagar or Malegaon or Jalgaon, all places which have been completely evacuated, the infection has been checked directly the townsfolk have gone out, and the surrounding country has been cleared very rapidly of any infection which has followed the evacuation. I do not think that the villages are of much importance, except near towns; but when a village gets infected near a town, it ought to be absolutely evacuated at once, under precautions that the villagers cannot enter the town.

26,547. You do not, therefore, think that the mere process of evacuation is likely to extend the plague to the surrounding country especially?—No; I think that if evacuation is done in the early stages it certainly will not. The only time it does extend the plague is when you get a very badly infected place, and turn all the people out. The result is that you stop a dangerous epidemic, and immediately infect 10 or 20 villages; but you turn these villages out at once. It takes a few weeks to get the place clear, but it is done, and the epidemic is over. I mean there is much less danger, as it seems to me, in evacuating a town like Sholapur, at the risk of 10 or 20 villages being infected, and having two or three cases in each village, than in keeping a central place like Sholapur infected for, perhaps, eight or ten months, during which time the infection may be going all over the country.

26,548. In either case there is a necessary risk of extension from the infected area, but on the whole you think that that the risk is almost smaller, where perfect evacuation has been adopted, than where the disease is allowed to run its own course?—Quite so, and the quicker the evacuation the less the risk.

26,549. Is there any other point you would like to bring before us?—I present this chart,* exhibiting the weekly total mortality of Bombay City to the Commission made up to date. I think it is a very remarkable chart. It is what we have had to guide us in Bombay City; it is the expectation we have followed both before and since the present epidemic re-appeared. It seems to me to point to certain conditions of the epidemic which are, perhaps, controllable—I will not say they are controllable, because I cannot say how far what we do may influence or not influence an epidemic. I hear statements that the epidemic is infinitely worse this year, and that we are going from bad to worse, but I do not think so at all. The total mortality last year in Bombay was over 55,000; we are now up to 40,000 deaths from all causes, and we have only two more months to run. I do not think we shall reach the 55,000 of the previous year in this present epidemic. Of course, I cannot tell what is in the future, but if the epidemic goes on as it has done, we ought to have only another week or two before it falls. We do not know how long the high mortality may continue up and down, forming what I may term a truncated cone on this chart, but the turn appears to have come just as it did last year.

26,550. Could you very briefly tell us what are the measures which are being adopted at the present moment in Bombay?—The two principal measures which are being adopted at the present moment are those which have been in force all along. Where a house is unsuitable for the patient to be treated at home, he is taken to hospital, and I am glad to say that I think in almost every instance the patient goes perfectly willingly, and with the concurrence also of his friends, some or all of whom accompany the patient, the reason being that the hospitals now are as attractive and comfortable as probably it is possible to make them. The only difficulty that I can see in the way of hospitals being thoroughly popular in this particular epidemic is the terrible death rate. As an exception, I may mention, the Plague Hospitals in Dharwar and Gadag, where I think there was a very considerable number of inoculated patients. The returns from these two hospitals are certainly remarkable. There are no two hospitals in the whole of the Presidency, so far as I am aware, which can show the same results in cures, and I take it that that is due to the proportion of inoculated patients who passed through the hospitals. I do not see any other reasons, because the death rate outside the hospitals was pretty stiff in the Dharwar district. There was no less virulent type of disease there.

26,551. From the evidence we have, we understand that very few inoculated persons have had plague at all in Dharwar?—In the hospital statistics of Dharwar and Gadag, you will see that there is a certain number of inoculated people who were admitted into the hospitals, of whom comparatively few died, and that, I think, must tell on the general percentages of recovery.

26,552. What further measures are being adopted now in Bombay?—There is evacuation of the infected house, if the house is not of a nature to be disinfected immediately, and the people allowed to go back immediately. If, for instance, it is a crowded and extremely badly constructed house, then there is evacuation, but it is a short evacuation. That, again, is a difficulty in Bombay. The people would go out a great deal more readily if they had not to go back again, but they do not like going back to the houses again—they would prefer to remain in the camp.

26,553. Because they are frightened of plague?—No.

26,554. Because they like the camp?—Yes. Directly they are out they infinitely prefer the camp. The great trouble is to get the people out. That, I have found, was the same in England. When I went to see a segregation building in London, I asked the Health Officer if he had much trouble in getting the people there. He said that there was a great deal of trouble in getting them there, but that they had sometimes to smoke them out. It is the same here. You give them a very comfortable, light, airy place, compared with the den from which they came. It is, of course, only the very poorest who go to these camps.

26,555. They appear to appreciate the surroundings?—Yes, and the absolute safety from the plague.

26,556. Are these the two great measures which are now being followed?—Yes.

26,557. Putting it generally, they are not quite so stringent as they formerly were in other epidemics in Bombay, are they?—The difference now is that perhaps there is not the house searching, but I do not know that that led to any more cases being discovered than now. Some people think that there were more cases found last year, and others think that there were less, but in all statistics you require to look very carefully to see how the figures are compiled before you accept comparisons.

26,558. House searching was not favourably regarded by the people, I think?—I think if measures have any effect at all upon the progress of the epidemic—if we assume that the present epidemic will begin to fall in the course of a short time, a few days or a week—if, that is to say, the present epidemic is going to draw the same pattern upon that chart which it has drawn in the two previous years, and if the measures have any effect at all upon the drawing of that line,—it stands to reason that the measures in the three epidemics have been very nearly equal in their effects on the mortality in proportion to the population. The measures may have some cumulative influence, or the epidemic may be waning, because the death-rate, in proportion to the population, seems to become rather less each year. The death-rate was highest in the first year, rather lower in the second, and I think will be lowest in the third; therefore showing that stringency does not lead to any better results than relying on the co-operation of the people, and not advancing in front of their intelligence, or rather driving them against their intelligence, but waiting until you can take their intelligence along with you, in which latter case you get far better results every year. I look forward to the intelligent co-operation of the people in Bombay with great hopefulness. I think, if the epidemic is to be conquered, it will be conquered through and by the people, as every other great reform in India always has been.

26,559. I understand there is a considerable exodus from Bombay at the present time?—There is some exodus, and perhaps you are right at the moment in calling it considerable, but that is only true of the exodus during the last week or two. During December of 1897, and January and February of 1898, 94,893 people left Bombay in excess of arrivals. In the same three months of 1898–9 the excess was 115, 863, a difference of some 2,000. Considering that this year the population has been very much larger than it was in the previous year, and that trade and the going backwards and forwards have been much brisker, the difference of 21,000 in the two years is a mere bagatelle—it is not worth talking about in a great population of 900,000. No doubt, if we had the figures before us of 10 years back, we should find that in one year there were 20,000 who left the town; in another year 30,000, in another year 5,000, and so on. But undoubtedly there is a difference this year. If you take the individual months, you will find that in January 1898, 52,430 people left Bombay, and in January 1899, 40,444. Up to that date there is no difference. This year, in fact, fewer left in January in proportion to the population than in the previous year. This deficit is made up by only 38,489 going out in February 1898, against

* *See* App. No. LXXXV. in this Volume. The chart was later completed up to May, 1899.

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79,481 going out in 1899. You may say this exodus in February is due to the increase of plague, or you may say it is due to very much fewer people having gone out in the month of January, compared to the month of January in the previous year, but taking the whole three months together there has not been anything unusual. Then at this time of the year the harvest is going on up-country, and there are perhaps two or three hundred thousand people who have come temporarily into Bombay, many of whom, after earning their bread here for two or three months, go back to their harvesting, and therefore, if there is an exodus now, I do not think it is very much in excess of the exodus which would take place in an ordinary year. The difference this year is, perhaps, that people are not coming in so freely to replace those who are going out, which very often happens. In the first 17 days of March last year, 18,234 people left, and this year, in 17 days, 53,980 have left. Last year the epidemic was going down during that period, or at all events was not very bad. There is the difference between 18,000 and 53,000.

26,560. Assuming there is no important difference in these two years, there is at the same time some slight difference at any rate?—There is some slight difference, but I should like to say that it is very much less than than we expected. Last year we tied up the town, we had the gates locked, so to speak. This year they have been opened absolutely, and we expected an enormous exodus, which, however, has not taken place. The reason we expected it was that last year the natives all said we would not let them go out, and that they were dying here.

26,561. Assuming there is no important difference between the exodus of this year and the exodus of last year, at the same time there is a slight difference, and I understand there is a slight difference in the degree of stringency of the plague measures, to the advantage of the present period; the measures are not quite so stringent now?—They are not carried on in the same way. There were certain measures adopted last year which which were very objectionable to the people.

26,562. How do you account for the exodus continuing, notwithstanding that the measures are not quite so irksome to the people? Do you think that the plague measures, or the plague itself, has had chiefly to do with it?—I think the best informants in Bombay will tell you that the exodus, so far as it extends to the lower classes, is very largely due to the reason I have given, namely, the annual reason—the harvesting, which calls for the return of a great number of people, who are cartmen, and porters, and mill hands, and so on, who have all got their agricultural interests up-country. Then the other reason which has come under my own notice to a certain extent, is that the higher class of people, among whom there is very little plague, but who are no doubt extremely sensitive—people who read the statistics every week in the paper, and get sensitive when a case comes near them—think that it is time to go, although they are not the class which gets plague. There is also some exodus due to the approaching hot weather.

26,563. Having regard to the facts which you have laid before us, do you think the exodus is chiefly to be accounted for by people wishing to avoid plague measures, or by people wishing to avoid the plague itself?—I do not think there is an exodus from Bombay now due to the people avoiding plague measures. There may be individual instances, but certainly not generally.

26,564. (*Mr. Hewett.*) Last year there was quarantine?—Yes.

26,565. You cannot compare the two years, because there was quarantine against Bombay?—Yes.

26,566. The people were not allowed to leave this place, unless they were segregated for 10 days?—Exactly. This year, although the gates are open, the exodus is extremely nominal. I do not think it is exceptional, except during the last week or two, and with regard to that, as I say, we have no statistics of previous years to set against it, but there is always a hot season exodus. I said the other day to some of the high class families in Bombay who were leaving here, and taking their wives and children to the extent of 22 or 23 members each, when they came to me to get letters of introduction—"Why are you going away?" and they said—"We go every year as the hot season comes on." They would not admit that they were running away from plague. They said, "If we had "been running away from plague, we should have "gone two months ago, or at all events a month ago, "but we have stayed right through the epidemic. We "believe the epidemic is now nearly over, but the hot "season is approaching and we are off." Whether that is true or not, I do not know, but I do not attach much importance to the exodus. I thought it would have been four or five times what we can show from our statistics.

26,567. (*The President.*) Then there is a reduction in the number of people who are entering Bombay?—Yes.

26,568. What do you think is the probable cause of that reduction?—The fear of plague. It is natural that people would not go to a town where there was an epidemic. That fear did not exist so much in the early days. I think that fear is growing on the people—the fear of going to an infected town.

(Witness withdrew.)

(Adjourned to London, *sine die*.)

At The India Office, London.

SEVENTY-FIRST DAY.

Saturday, 6th May 1899.

PRESENT:

PROF. T. R. FRASER, M.D., LL.D., F.R.S. (*President*).
Prof. A. E. WRIGHT, M.D. | Mr. A. CUMINE.
Mr. C. J. HALLIFAX (*Secretary*).

Surg.-Gen. C. Planck.

6 May 1899.

Surgeon-General C. PLANCK called and examined.

26,569. (*The President.*) You have retired, I think, from your appointment of Superintendent-General of Vaccination and Sanitary Commissioner in the North-Western Provinces and Oudh?—Yes, I served for about 20 years as Sanitary Commissioner and Superintendent-General of Vaccination in the North-Western Provinces and Oudh and retired in 1886—13 years ago.

26,570. You have prepared an interesting Report upon Mahamari, which we propose to print in the

evidence* ?—Most assuredly it is at your service. My desire in writing that Report was to record the facts noted at the time of inspection, unprejudiced by theory.

26,571. We will assume that that is taken in, but there are a few questions we wish to ask you in addition.

26,572. (*Prof. Wright.*) I would like to know more of the conditions of the people who infect themselves by visiting plague houses, as I believe they do?—So it has seemed to me.

26,573. I am anxious to know whether these people wear shoes or stockings?—The heads of the villages, such as the Padhan (Headman) do wear shoes, but the poor people have no shoes. The poor people go about in their naked feet. I never saw a poor man with shoes, to the best of my recollection; they would not dream of shoes—they have no men to make shoes. My experience of the disease was gained in isolated villages far away from civilisation. The value of my report, to my mind, lies in its proof that plague was in India long before the existing great trouble arose. The same disease was in Kamaun and Garhwal as now prevails in the plains, without apparent differences. Some medical authorities inclined to the opinion that the disease was a severe form of typhus, but that, I think, was a mistake. It was true plague and could not be otherwise named in English. With reference to the present outbreak in the plains, of course there seems to be a suspicion that it may have been imported to the plains by some person or goods coming down from the Hills. But there is a considerable traffic by ships and junks between Hong Kong, where plague prevails, and Bombay, and that seems to me the more likely route of plague introduction to the plains of India.

26,574. Is there any traffic between Garhwal and Thibet?—In the spring and summer people are passing to and from Hundes, a country in the neighbourhood of Thibet; they travel across the passes when the snow melts, especially many flocks of sheep laden with borax in small bags accompanied by men and women (*see* para. 222 of the Report)*; most assuredly they would be in contact with people on the other side of the Himalayas. I do not know whether there was a prevalence of plague in the Himalaya mountains beyond British territory, but there was in China, in Yunnan itself, as mentioned in the last paragraph of Dr. Watson's Report.* Yunnan is a country of great extent, but part of it is on the China side of the Himalaya mountains.

26,575. Do you think the outbreak of plague in Garhwal might be due to this cause, or do you think the germ lives in the country?—I think the germ lives in the country of Garhwal and Kamaun. I think from the statements of my report, small in degree as they are and, perhaps, unimportant from the present extending view of the disease that plague broke out in the villages which I inspected in this way. It was generally a child or a woman living almost continually in the house who first suffered, and the cause of the disease seemed to be in the house itself. With regard to preventing the people from remaining in their habitations after plague has attacked a member of the family, I think you will find that when plague becomes well-known in the plains of India the people will flee out of their houses of their own accord. I have been 32 years in India and I never heard of a case of plague in the plains of India in all that time, so that the plains people know comparatively little about the disease yet. I believe you will find that if plague goes on for two or three years, the relatives of the sick person will flee away and leave him in the house. They will vacate their habitations. Plague has existed in Garhwal and Kumaun probably for centuries. By the present native generation it was supposed to have been commenced as a manifestation of God's displeasure, owing to the incorrect, or new, method of performing a certain religious ceremony by the then head priest (*see* para. 45 of Report).* Of course these unusual ceremonies had nothing to do with the outbreak of plague. It must be due to a specific microbe or some hurtful influence of that character (para. 248).*

26,576. Do you find that people may go on having plague when they do move out of their houses?—Yes, they would carry away the disease with them to the hut in which they lived on the hill side. That was not a frequent occurrence, but it did so happen occasionally, as the histories of the Report* show. As a general rule, the re-appearance of the disease amongst the people who had vacated the family home, arose out of the return of a number of the family to the home to fetch grain or other food, or to house cattle at night. The people, when they vacated their homes, lived in temporary huts, high up on the mountain side, or in caves. The disease seemed to be in the houses, and the people knew it, for in some instances, they tried to persuade me to burn their houses, and even burnt them of their own accord (para. 262).*

26,577. Are there many rats in this part of the world?—There are many delicate grey rats, but different in appearance to the rats of Europe.

26,578. Was the mortality among rats always noticeable in plague epidemics?—Not always. The rats I saw were grey in colour, rather squirrel-like, and about as long as a man's hand. As a rule, the death of rats in a house seemed to presage the appearance of plague disease *de novo* there, where rats had not died the outbreak of plague disease in the house appeared to have resulted from contagion. The rats did not seem to me to have died from poison, but from suffocation (para. 254).*

26,579. Did you see any rats dying?—No.

26,580. You did not observe that they died a very long lingering death?—No, they were found dead on the floor at night among the sleeping people.

26,581. Did you find many mild cases of plague occurring in association with these severe cases?—I do not think there were many mild cases. I had a history of 240 cases, and only 17 cases recovered, so that they must have been severe, as a rule.

26,582. Do you think that buboes are familiar objects to the people of these parts?—Syphilitic buboes do you mean?

26,583. No, I mean generally, are the people accustomed to suffer from mild buboes, or is a bubo a rarity in these parts?—I should say that syphilis is rather prevalent among them, and I should suppose buboes would be, but Medical Officers of Dispensaries know more about buboes of that character.

26,584. You have never been up in these Hills except in plague times?—I have been there for 12 years on and off.

26,585. If cases of mild bubo occurred there, would they have come under your observation?—No. I know that syphilis is very prevalent in the Himalayas, but I do not think there can be any doubt about the plague disease I saw, because I examined patients, and they had a temperature of 105 to 110, the pulse at 120 and 130, and some died in 12 hours after the attack commenced, and then no buboes were visible.

26,586. I do not think you noticed in your report congestion of conjunctivæ as a sign of plague?—No, it is so long ago, that I do not remember it. It was not likely that I should have noticed it if it had existed. At para. 117 of my report, the eyes were seen to be "suffused." I think that points to congestion of the conjunctivæ. But I cannot be sure now. I certainly did not make a point of looking for conjunctivitis. Generally, the patients eyes were closed.

26,587. Have you noticed that in their delirium, the people were inclined to wander about?—Yes, and fall down, or throw themselves down into the ravines. There are one or two cases recorded in my report that so ended in death.

26,588. I understand you to say that the grain did not seem to cause any infection?—No, I think not, Dr. Watson thinks it did, as recorded in his report appended to my own report.* I do not think you will find plague disease is due to any hurtful character of the grain consumed, but to something much more serious than any unwholesome food. I am quite sure the people will flee away from their homes if the plague continues to prevail in the plains of India. They will leave their sick friends and flee away as from certain death. It was so with regard to this plague, or Mahamari, in Garhwal and Kamaun. The prevalence of the disease was not known to the authorities for some time, until at last the Commissioner of the Province noticed that the people suddenly left their homes, and inquired as to the reason for this unusual flight. "Mahamari" is not the native name for the disease to avoid which they fled away. Mahamari means any deadly form of

* *See* App. No. XXV. in Vol. II. of these Proceedings.

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disease. "Gola-Rog" is the correct local name for plague, its exact translation being "bubo-disease." "Rog" is the Sanskrit word for disease, and "Gola" for bubo or boil. Any epidemic form of disease, for example, cholera, is called Mahamari during its prevalence (*see* para. 245).* The Civil Officers of the Government, recorded the term "Mahamari" as the native name of the disease, hearing it so spoken of. But the true native name of the disease is as good a definition of plague disease as any yet recorded, I think. Anyway, its fairly accurate translation as "Plague of Boils" is strangely in accord with the sacred record of the disease from which Egyptians had to suffer in the time of Moses.

26,589. Did any epidemic come under your observation where the mortality was comparatively mild?—I have seen no other cases, except those which are mentioned in my report. There were comparatively few deaths in any one village—about, at most, 14 or 15. This I attribute to the fact that the people vacated their homes quickly, taught by experience. Absolutely all my knowledge in regard to plague disease in Garhwal and Kumaun stands recorded in my report* which is to be printed in evidence.

* *See* App. No. XXV. in Vol. II. of these Proceedings.

(Witness withdrew.)

Surg.-Col. J. Richardson.

Surgeon-Colonel J. RICHARDSON called and examined.

26,590. (*The President.*) I believe you have served in the Vaccination and Sanitary Departments of the North-Western Provinces of India?—Yes, I have served for over 30 years in India.

26,591. Will you tell us between what dates you served?—I entered the Service on the 27th July 1859, and left on the 19th May 1894.

26,592. And you have had some opportunity of observing the disease which resembles plague in Kumaun?—I have.

26,593. (*Mr. Cumine.*) On how many occasions had you that opportunity?—Only two occasions that I can distinctly remember.

26,594. Did you see many cases or few?—I saw few.

26,595. Had you any opportunity of watching a case from its beginning to its close, or making a *post mortem* examination on the body of anyone who had died of this disease?—No, I had not.

26,596. In what years did you visit Kumaun?—In 1884 and 1886; but I visited Chaudans in 1876. I did not see plague there, but I was in a village from which the people had just fled on account of the plague, and I saw dead rats there. That is the only material fact I can remember in connection with it.

26,597. Will you describe your first visit in 1884?—When I reached the village of Liti near Shama, on the way to Tejam, I found the place deserted and partly burnt down. The inhabitants were living in shelters at some distance from the village. I could get none of them to enter it with me. In one house I discovered the dead body of a young man, of about 20 years of age, in a sitting posture, resting against the wall. Death had taken place too long previously to make it possible for me to come to any conclusion from the examination of the body as to the cause of death. The mother of the lad came to within about 100 yards of the village; and, with tears, told me of her son's illness, and of his death from gola or phutkia. She said she was not allowed to stay with him or to go and see to the disposal of his body. None of these people spoke of mahamari, only of gola or phutkia.

26,598. How did they describe the disease to you?—As a fever which began like an ordinary fever, but which speedily became violent, depriving the patient of sense and proving fatal in from two to three days.

26,599. Did the people who developed swellings in the groin or armpit seem to have a better chance of surviving, or a worse chance?—They did better because they lived longer. They did not develop swellings until some days had passed. Those of the sick who survived for a longer time showed swellings in their groins and armpits.

26,600. In this case was there any history of the death of rats in the village before or during the outbreak?—There may have been, but I cannot remember.

26,601. Will you describe to us your visit in April 1886 to the village of Bargaon?—I remember all the salient features of my visit there, but I do not remember the details. In April 1886, I visited the village of Bargaon in Kumaun, near the road after it crosses the Ramganga leading into Garhwal. The village had been evacuated by the inhabitants excepting by a man who was ill with gola, and too weak to move. This man had swellings in his groins, and was suffering from fever, but was quite sensible, and was in hopes of getting well. The swellings, he said, were getting smaller; there certainly seemed no tendency to suppurate. A relation came and placed food and drink by him, and he was attended to by a Hospital Assistant from the Ganai Dispensary. Some of the other villagers had been ill but were recovering; they were living in the vicinity of their village, although they did not enter it.

26,602. How did the villagers say the disease began in this place?—They said it began as the ordinary kind of fever—they called it sanjar—which is not uncommon in the Hills. It becomes contagious, I believe; anyway, it prevails in an epidemic form in villages, but it is unaccompanied, so far as I know, by bubonic enlargements.

26,603. In this case, after the sanjar had gone on for a little time, did they notice that anybody had a swelling in the groins?—They did. The account they gave me was that when they were carrying one of their number down to the little stream below, to burn the body, they noticed swellings in the groins, and they hastily threw down the body. I think the Patwari told me it had been eaten by jackals. Anyway, it was thrown down and the people cleared out of the village.

26,604. When they discovered the swelling in the groin did they say: "We were wrong in supposing it "to be sanjar; it turns out to be something else"?—That was their belief, that the disease which they had in the first instance thought to be sanjar was actually gola. They did not imply that the disease grew from sanjar to gola; that was my own idea, not theirs. They said that at first they believed it was fever, and seemed to think it was ordinary sanjar, severe form of fever, something of the nature of typhus. Then when they were taking this body down to be burned, after several had died of the other disease, they discovered these swellings, and said they had made a mistake and that it was a more severe form of the disease. I will not say they said that—I made a mistake—because they did not connect the two. They said it was gola. I never heard them make use of the word "mahamari." They threw the body down and cleared out of the place. They were not afraid of the first disease, but with regard to the other one they said: "This is the real "'golarog' which will kill us all," so they left.

26,605. Did you understand that golarog and sanjar were distinct diseases, or that golarog is merely a severe form of sanjar?—I did not gather from their account that they believed the diseases to have any connection. At least they did not express it to me, and I never heard them say that the two diseases were identical.

26,606. Did you observe anything which showed that a house remained infected after the people had abandoned it?—They told me that one man had died after the village had been evacuated by all the people, and that this was a man who went back to fetch some grain, or flour, out of his house. After the visit to his house, he contracted the disease and died. That is the account they gave to me; it is not what I saw.

26,607. In this village of Bargaon did the people tell you anything about the death of rats?—I cannot remember that. Probably they did, but I could not say they did. I am speaking from memory.

26,608. Ten years before that—in 1876—when you visited Chaudans in Eastern Kumaun, had you been shown any dead rats?—The village at the time was empty; but a man who belonged to the village came round the village with me, and showed me some dead rats. He said: "These have been dying about here; "they died before the outbreak of this phutkia."

26,609. You saw several villages in which golarog had been prevailing in 1876?—Yes.

26,610. Did you see any cases yourself?—No, I did not.

26,611. What is the character of the dwelling-houses in that part of the country?—The dwelling-houses are generally dark and ill-ventilated. One had almost to enter on hands and knees, and could scarcely stand upright after entering. These rooms, or rather garrets, were crowded with baskets of grain, baskets of wool, and goatskin bags of flour, wooden vessels filled with ghi and other domestic belongings; usually the cattle occupied the ground floor underneath these garrets or lofts.

26,612. Is that general?—That is pretty common, I believe; that is not confined to Chandans alone.

26,613. Have you seen any cases of the plague which is now prevailing in the plains of India?—Yes, I saw them in a cursory way in a hospital at Sholapur—about 18 or 20, so far as I remember.

26,614. From the cursory examination which you were able to make, did the disease appear to you to be similar to the one in Kumaun?—Most distinctly. I would not say it was identical. I did not enter into an examination of the cases sufficiently to entitle me to express a decided opinion.

26,615. (*Prof. Wright.*) Was the plague of mahamari spoken of by the people there as a familiar thing, not quite a new thing?—As a familiar thing. They seemed to be quite accustomed to visits, if not in their own villages at any rate in other villages about. They did not speak of it at all as a new thing. They were very much afraid of it; but it was not a thing that came upon them as an unexpected calamity.

26,616. They are familiar with both sanjar and golarog?—Yes, they are familiar with both.

26,617. Do you think the outbreaks in this district might be caused by importation from the far side of the border?—I would not say what is possible or impossible; but it struck me that it might be that the disease may have originated in this way. I suppose you must have germs before they can live, but the conditions were such in these houses as certainly to encourage the development of contagious fever of the nature of typhus. That was the idea we all had for many a day.

26,618. You thought the local conditions were sufficiently bad to account for the disease without any theory of importation?—It might have been imported from time immemorial, and the germs may have remained there in a latent condition. They may have become excited by the excess of those conditions favourable to their development.

26,619. Do you know if the people in this district wear shoes on their feet?—The wearing of shoes is, I think, chiefly determined by the part of Kumaun dealt with—low down in the warmer parts they are, as a rule, not worn; high up near the snows both shoes and socks are often worn. The people do not always wear shoes, I allow; they do not in the summer time any way.

26,620. Cases came under your observation where people got plague from re-visiting their houses after the houses had been evacuated?—Yes, I have heard repeatedly of that.

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26,621. In cases of that sort, did the people who returned to their houses wear shoes, or did they go about barefooted?—I cannot say, because I do not remember.

26,622. You do not know what the habit of the country is?—I know the habit of the country well.

26,623. Is it the habit to wear shoes, or to do without them?—The majority of them do not wear shoes. The coolie people and the labouring classes, who form the bulk of the poor people of the community, do not wear shoes as a rule.

26,624. Not even in winter?—That I do not know; I have not been there in winter, but I think not. The better classes nearly always wear shoes with a sort of woven woollen uppers and leather soles. The "uppers" are usually made of woven woollen bands.

26,625. Do you know what their sleeping quarters are like, do they sleep on the ground?—They sleep in the lofts; in the upper storeys.

26,626. Do they sleep on the floor?—Yes, they do not have beds. I have never seen anything in the way of beds in most of the places I have been in. The people sleep just on the boards on the loft or garret in which they live. Some live in the lower storeys.

26,627. What are the floors made of in the upper storeys? Is the upper floor a boarded floor?—Yes.

26,628. Is the floor bare boards, or is it covered with cow dung?—I do not think I saw that: it was very dark. In the lower storey, probably, they have cow-dung floors.

26,629. (*The President.*) There is much cow-dung in the lower floors?—Yes; they were generally covered with it; the cattle lived there.

26,630. A foot or two of cow-dung?—Perhaps so; until the season came when they carried it out in baskets and put it in the fields.

26,631. In the upper floors, what were the means for ventilating the rooms?—The ventilation found its way between the slates. They were mostly covered with big, coarse, thick slabs. There were bits of holes now and again, in which they stuffed something, as a rule. They were very ill-ventilated and dark places. I remember particularly about the darkness—you knocked your head against the baskets and things when you went in. They were pent-roofed, as opposed to flat-roofed, affairs.

26,632. (*Mr. Cumine.*) I understood you to say that they regard the two diseases, sanjar and gola, as separate?—They did not seem to do that.

26,633. Therefore, they might regard one as a familiar thing, and the other as a new thing?—They were familiar with both.

26,634. (*The President.*) Perhaps the difference they particularly attended to was that one was a dangerous disease and the other was not?—The other was not so dangerous. I think, that is the feeling.

(Witness withdrew.)

Surgeon-General JAMES CLEGHORN, I.M.S., called and examined.

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26,635. (*The President.*) You are a retired Surgeon-General?—Yes.

26,636. You have lately acted as Director-General?—Yes.

26,637. You are able to give us an account of the measures which were adopted in connection with plague throughout India, which came under your official knowledge, from 1896, until you left India?—Yes.

26,638. That evidence is in your printed statement which you put in?—Yes, it is as follows:—

[*This Note must necessarily be incomplete, as some time has elapsed since my departure from India, and I have not now access to the office records.*]

In August 1896 a peculiar form of fever, of a fatal type, was observed by some of the medical practitioners in the City of Bombay. In some instances it was accompanied with glandular swellings, and in others with pneumonic symptoms; but none of the observers had apparently seen a similar disease before, and they naturally hesitated regarding the diagnosis. A death was said to have been registered on the 31st August as having been due to "bubonic fever," and on the 23rd September, Dr. Viegas, I think it was, who reported to the Municipal Commissioner that plague was present in the City. Others, however, doubted the correctness of the diagnosis; but on the 29th September the Government of Bombay telegraphed to the Government of India, that the Surgeon-General of Bombay had reported having seen 20 cases of plague, all of a mild type. On that date the Government of India telegraphed to Mr. Haffkine, then on cholera inoculation duty, to proceed at once to Bombay, and report to the Government of India his opinion, after having made a thorough bacteriological examination of cases He reported, on the 13th October, that the disease was undoubtedly plague.

Although no deaths from plague appear in the mortuary returns for September, yet, on the recognition of the disease as plague, its presence was discovered in nearly all the quarters of the City. The disease at first spreads slowly and irregularly, and its

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diffusion in October showed, I think, that cases of the disease must have existed for some time previously.

In the latter end of September the Government of Bombay appointed a Committee, composed of official and non-official medical members, with Mr. Snow, the Municipal Commissioner, as Chairman, to advise the Municipality as to the measures which should be taken towards stamping out the disease, and improving the sanitary condition of the City.

Acting on the advice of this Committee, Mr. Snow, on the 6th October, issued a notice to the inhabitants, making provision for the removal to hospital of all plague patients, and for the evacuation—compulsory if necessary—and disinfection of all houses in which cases had occurred. A hospital was opened in Arthur Road for the reception of cases, and huts were erected for the isolation of individuals who were liable to infection.

These proposed measures gave rise to great excitement among the population; large numbers left the City, and crowds assembled round the hospital, threatening to destroy it and assault the staff. The conservancy staff of the Municipality became disturbed, fears were entertained that they also would leave the City, and thus put a stop to the ordinary cleansing of the town and to all sanitary work in connection with the plague.

The cases of plague being at the time few in number, and the disease showing little or no tendency to increase, it was considered advisable, in view of the popular excitement, to modify the measures published on the 6th October. The Health Officer was accordingly instructed, on the 16th October, not to remove patients living in houses where they could be isolated and properly attended to; and on the 30th October rules modified in this direction, were published for general information. Hospitals were at the same time established by private individuals for the treatment of cases belonging to different religions and sects; but they apparently failed to attract patients.

In the meantime, the large staff of officers and subordinates employed by the Municipality worked most vigorously in cleaning and disinfecting houses, improving and extending the drainage, and in attending generally to the sanitary wants of the City.

All their efforts, however, failed to check the progress of the disease, and, as the Government of India could not, from the details received, clearly appreciate the actual state of affairs, or satisfy themselves as to the extent and efficiency of the measures adopted, I was directed to proceed to Bombay and make myself acquainted with the facts. I accordingly left Calcutta on the 4th January, arriving in Bombay on the 7th. In company with various Municipal officials I visited different localities infected and inspected a large number of the houses and rooms in which cases had occurred. These houses had distinctive marks on the front wall, showing the number of deaths and cases which had occurred in each, so that there was no difficulty in recognising them.

I was much struck with the enormous amount of work which had already been done by the officers serving under the Municipality, but I at the same time realised that the situation was, as regards the prevention of the disease, a hopeless one, unless the scheme was made more comprehensive. The incidence of the disease showed that it had chiefly appeared in the worst houses, and that the better ones, including the small hotels situate in the infected quarters, had practically escaped.

I had, of course, a considerable experience of the conditions under which the poorer classes in other parts of India lived, but I had never seen anything so bad as existed in the chawls of Bombay.

After I had made myself fully acquainted with the condition of affairs, I invited the leading medical practitioners, both official and private, and the various experts, to meet me and discuss the question at the office of the Surgeon-General. Their views, as published on page 288, Vol. II. of "The Plague in India" compiled by R. Nathan Esq., C.S., I submitted to the Government of India, and strongly recommended that they should be adopted and acted upon. This was done and the measures enforced by the Government of India were in future based on the following lines:—

1. Early detection of cases.
2. Segregation of the sick and their treatment in suitable hospitals.
3. Removal from infected localities of those liable to infection, and their segregation.
4. Disinfection of clothes and other articles liable to infection.
5. Disinfection of houses situated in an infected locality.
6. Enforcement of general sanitary measures.

The authorities in Bombay were, however, so impressed with the local difficulties attending compulsory evacuation and providing temporary accommodation for the segregation of the people removed, that little was done in this direction.

I left Bombay on the 13th January, arriving in Calcutta on the 16th. After clearing off the more important arrears in the office, I left for Karachi on the 22nd January, arriving there on the 26th, but was only able to remain there until the following evening, as I was ordered by the Government of India to proceed to Venice, as delegate to the Conference on plague about to assemble there.

The steps being taken at Karachi were in accordance with the views of the Government of India, and under the direction of Mr. (now Sir) A. Wingate, they proved ultimately successful. No force was employed to move the people into huts. It was accomplished in time by the personal influence of the officers, assisted, no doubt, by the fear created by the presence of plague.

I arrived in Calcutta on 31st January, and left for Venice on 4th February, and reached Venice on 20th February, some days after the opening of the Conference.

Quarantine was in force both at Brindisi and Marseilles. As a delegate, I was allowed to land at the former port, but the steamer with the other passengers had to proceed direct to England. While in Venice I succeeded in obtaining the intervention of the delegates from Italy and France towards removing the quarantine.

I had, while in transit, prepared a note on the characteristics of the disease as presented in the outbreaks at Bombay and Karachi, its progress up to date, and the measures taken by the Government for controlling its spread both by sea and land. The note was read at the Conference, and the information furnished appeared to satisfy the delegates that the Government of India were taking every precaution to arrest the progress of the disease, and in preventing its spread to other countries. The results of the Conference were, from the Government of India point of view, satisfactory.

After reporting to the Secretary of State for India, I returned to Bombay in April. On arrival there I found that plague operations in the City of Bombay had been entrusted to a Committee, of which General Gatacre was President. I had the advantage of being taken over several of the hospitals by him, and of learning from him the organisation in force.

The objects the Committee had in view were:—

1. The discovery of all cases of plague.
2. The treatment of all cases in hospitals.
3. The gradual segregation, as far as possible, of the probably affected, that is, of those living in the same room with, or in close attendance on, persons suffering from plague.

The work of the Committee also included all sanitary measures, the disinfection of houses, and the destruction or alteration of those considered unfit for habitation.

The removal and segregation of those liable to infection were not carried out on any extensive scale, or in the manner desired by the Government of India; but the organisation, and the methods employed for carrying out the other objects, were of the most complete and perfect character. Except at first, little or no opposition was experienced, and General Gatacre, by his tact and great personality, carried the whole population with him.

On leaving Bombay I took over charge of my duties at Simla. All papers and questions regarding plague were passed on to me for information and remarks, and the necessary orders were issued by the Government of India. With further experience the rules were elaborated, and, in some instances, modified to suit local conditions; but the main principles, as previously laid down, were invariably adhered to.

The reserve of officers on special plague duties was fully utilised. Many officers were removed from their ordinary appointments, and placed on plague duty. In the case of outgoing steamers and craft from Bombay harbour, all the crews and passengers were inspected by

the Port Health Officer, who was assisted by a staff consisting of an additional Port Health Officer, three Commissioned Medical Officers, three Military Assistant Surgeons, one Hospital Assistant, and two lady doctors. When the stress of work was great, or when time was of importance, the Port Health Officer obtained further help from the medical staff engaged in other duties in the city. The work thrown on these officers was exceptionally heavy, and the thorough manner in which it was performed was proved by the results.

Posts of inspection, numbering 221, were gradually established on the different lines of railway, at the principal stations and junctions. Forty-six of them were under the charge of Commissioned Medical Officers. Huts were erected at a large number of the stations for the treatment of the sick, and for the segregation of suspects. There were altogether employed entirely on plague duty 64 Commissioned Medical Officers, 41 of whom belonged to the Indian Service, and 21 to the Army Medical Staff; 20 private practitioners; 31 Military Assistant Surgeons; 36 Civil Assistant Surgeons; and 211 Hospital Assistants; besides a number of lady doctors and nurses. Other officers and subordinates, holding regular appointments, always assisted when their services were required.

So far as I can remember, no complaints were received by the Government of India as to the manner in which these officers discharged their duties, except in two instances. One was with regard to a native of India, who was a member of the Indian Medical Service; the other concerned a Military Assistant Surgeon.

In addition to the above, there were employed on sanitary duties 45 British officers, 16 native officers, and 1,617 non-commissioned officers and men.

The additional requirements for medical officers for famine and war proved too great a strain on the two medical services, and in July or August private practitioners were obtained from England for plague duties.

In October, a Commission, consisting of Sir A. Wingate, Surgeon-Colonel Hay, and myself, was appointed by the Government of India to visit the places in the Bombay Presidency attacked with plague and to see how the operations were being carried on. I left Simla on 1st November, and visited alone, or with the other members, nearly all the infected localities. The objects of the measures and the manner of execution were carefully explained to all the officers concerned, and our visits were much appreciated. It was difficult for local officers to grasp the object of written orders on such a complicated subject. Inspection of travellers at the different stations was rendered more complete, and means of disinfecting clothing by steam were introduced at appropriate stations. Local measures were introduced on a systematic plan. Our recommendations with regard to each place were forwarded to the Governments of India and Bombay.

On my return to Calcutta on 24th December, I drew up fresh instructions regarding plague administration for the general guidance of district and other officers, which embodied the results of the experience gained on the tour. This note was circulated to all local governments and administrations for information and guidance, with the Government of India Resolution, No. 227—240, dated 3rd February 1898.*

The large amount of extra work, both clerical and inspectional, thrown on me by the plague, proved too much for my constitution, and on my return from the Bombay tour, I felt unable to continue in office. With the consent of his Excellency the Viceroy I left India in March.

26,639. I think there are only a few questions which we have to ask you?—I gave everything I could think of in connection with the administration of plague, and the different measures which were adopted.

26,640. You often visited Bombay and Karachi and the other important towns and districts which were affected with plague?—Yes.

26,641. And you were impressed with the insanitary condition of some of these towns and districts?—Yes, the condition is common to all Indian towns.

26,642. You thought that insanitary conditions were specially prevalent in Bombay, I think?—Yes, in the houses.

26,643. You do not refer so much to the general conservancy as to the houses?—That is so.

26,644. You thought that these houses were, in that respect, worse than those of Calcutta?—Worse than any place I had seen, owing to the enormous number of people who lived under the same roof. I have never seen anything like such overcrowding. In a place, probably, the length of this room—6 feet by 12 feet—I have seen the floors covered with people lying down, and in addition, beds hanging from the roofs on which other people slept at night. There was absolutely not one ray of light or any means of getting air to these rooms. We had to strike a match to see the opposite walls, because it was so dark, and that was in the middle of the day.

26,645. I suppose the ceilings from which they suspended their beds were not very high?—No, they were not. I have never seen anything like such overcrowding in rooms absolutely without any means of ventilation. All the windows, when there were windows, were closed with rags and remnants of bedding.

26,646. Where these windows existed, I suppose they were not large?—No, not in all cases.

26,647. In many cases they opened into a narrow space?—Yes, on to the wall of another house.

26,648. Where the air was necessarily foul?—Yes, the drains in the alley between the houses were open, and the passages were just wide enough to allow the sweepers to get up to sweep the drains, therefore, to ensure privacy from the inmates of the next house, all the windows were covered up with clothing, &c.

26,649. Is it within your knowledge that plague was specially prevalent in these places?—Yes, especially in these insanitary houses. I gave a description of these chawls in a note I submitted to the Plague Conference in Venice. I have not quoted it in my evidence. It is in Mr. Nathan's compilation. I have given a précis of it in my evidence.

26,650. You have given a précis of it in your evidence, but a fuller description will be found in Mr. Nathan's compilation?—Yes.

26,651. Your refer to several alterations which took place in the measures which were adopted to meet plague at different periods and times?—Yes, as our experience increased, and as the difficulties presented themselves to us, the rules were elaborated—the complete rules which were ultimately accepted were those issued by the Government of India to local governments.

26,652. Numbers 227-240?—Yes. That gives the complete rules. We acted on those rules previously, but they were elaborated so as to meet the work which the district officers had to contend against.

26,653. These were issued in February 1898?—Yes.

26,654. But there were also modifications which were not so much dependent on the reasons which you have given, but upon the difficulties in carrying out proposed regulations?—Yes, but it was after my trip with Sir Andrew Wingate through the plague-stricken districts that we thoroughly realised what these difficulties were. It was impossible sometimes to carry out certain rules.

26,655. What was the nature of the difficulties?—There were difficulties with regard to preventing people in infected districts getting out of the districts, not by railway, but by country roads. You could not have possibly controlled all traffic. The local officers knew exactly the local conditions and were advised to act according to circumstances.

26,656. Were not there difficulties also due to the opposition of the people themselves to certain steps which you wished to be carried out?—We never had serious opposition after the plague was fully established, so far as I can remember. With a good local officer there would be few difficulties. If a local officer took time to carry out the measures and got the leaders of the people with him, there was little difficulty. In Surat, for example, there were 20,000 people in huts in different camps, 4,000 or 5,000 in each camp, and there was not the slightest difficulty there. The officer in charge was possessed of tact, and had great influence with the people, and he carried them with him.

26,657. It was the personality of the man?—Yes. I heard there was opposition on the Great India Peninsula Railway line in the villages, and there was opposition in Bombay City at first.

26,658. In what way did that opposition show itself?—They absolutely refused to allow the removal of the sick, or to evacuate the houses in which the sick were Mr. Snow then modified the rules.

* Not reprinted with the Proceedings of the Commission.

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26,659. To what extent?—He did not remove the people from the infected localities.

26,660. Was it made optional with the Health Officer?—Yes.

26,661. After proper isolation?—If proper isolation could be made and the patients could be properly attended to in their own houses they were allowed to remain there.

26,662. And with regard to contacts and the people in the neighbouring houses, they did not attempt to do anything with them at that time?—No; I do not think so. It was never completely done in Bombay. Evacuation was never carried out on the scale necessary to make the measure thoroughly effective.

26,663. Do you think it was an impossibility?—The local officers and the local government said it was an impossibility.

26,664. They have now, however, established a very large number of camps in Bombay to which people are removed?—They did, for a time, before I left—there were camps then. It was said there was not enough space, but there are open spaces in Bombay. There were places in the immediate neighbourhood where people could be taken by train. Of course it means a great organisation and expense, but the point was that here was a disease in Bombay City, and that the whole of India was imperilled, and the commercial relations of the city seriously affected for the time being, unless the plague could be exterminated in Bombay. The feeling was that, with so much at stake, it was really worth while acting on the rules which were considered advisable, notwithstanding the great expense which would necessarily be incurred.

26,665. At first, in several large towns, not so much, of course, as in Bombay, there was, undoubtedly, a good deal of opposition, I think?—As for instance?

26,666. I mean in every large town?—There was passive opposition.

26,667. Against segregation?—It was always, I think, opposition in a passive form.

26,668. Has that been got over?—That has been got over, to a large extent, by the tact, firmness and individuality of the officers concerned. Little or nothing was known about the plague in Sholapur until it was nearly all over the town. The early recognition of the disease is one of the difficulties, but eventually the whole place was evacuated.

26,669. But they had a difficulty at first?—Yes, a great difficulty. The inhabitants concealed the existence of cases.

26,670. Was there any fear of active opposition?—There is always that danger, as a very slight matter might develop it. In carrying out measures affecting the habits and customs of the natives there is always the feeling that opposition may be aroused, unless the local officer is conversant with the people and has gained their confidence.

26,671. From what you stated a moment ago, I assume that you think evacuation is a very valuable measure?—Yes, evacuation of a locality, that I am perfectly clear about.

26,672. You think it is the most effective measure?—Yes, it is I think, the most effective remedy, because the plague as I saw it was absolutely a disease of locality. What struck me going through Bombay was that none of the good houses were attacked, not even the small hotels where sailors and others lodged.

26,673. There was not plague even in those quarters?—No. The sanitary arrangements there were fairly good. I do not think that a single case occurred in those small hotels.

26,674. Was there plenty of light and no overcrowding in these houses?—That is so. They were like the dak bungalow arrangements in India, and the places were built according to European ideas. There was no overcrowding, of course.

26,675. Have you any instances in which evacuation was very successful?—I suppose you have many?—Yes; when taken in time, and we have early intimation of the cases. Under those circumstances evacuation almost invariably arrested the disease. It was arrested at Chandausi, but it took some time, and also in Khandraoni, Dr. Crofts stopped the disease there at once. Its progress was also arrested at Surat and in Karachi. It took Sir A. Wingate weeks to get the people to leave the town.

26,676. What is the population of Karachi?—I think about 100,000. The evacuation of the town was a most difficult undertaking, and was carried out by sections. Sir A. Wingate worked very carefully. He built huts, acting, I think, under instructions from the Government of India, and he got one section of the town evacuated. Gradually all the people were located in huts, and the disease was arrested there for a long time. It was a very great undertaking indeed.

26,677. In a large place you think a great deal might be done by evacuation in sections?—Yes, it was always found that when the disease was reported in a village or a town, there were invariably cases found in the vicinity of those reported, so that it was not only necessary to evacuate the houses in which a case was reported, but also the houses in a certain area round about.

26,678. When you are dealing with a very large population, much, if not all, the benefits of complete evacuation may be obtained by evacuating the people in sections?—Yes.

26,679. There is almost no limit so far as population is concerned if they are treated in sections?—Except as to the accommodation which you can provide.

26,680. Supposing you can dispose of 40,000 or 50,000 people at one time, that practically comes to almost no limit, so far as the population is concerned?—Not if you have places in which to accommodate them and you have the organisation which is necessary. Of course, even then it is not so effective as complete evacuation would be when carried out in the case of a small community. But the only practical way to limit the disease is to get the people out of the quarter.

26,681. You may, at any rate, much lessen it, even if you do not altogether stop it?—Absolutely; that, I think, is perfectly clear.

26,682. In some of these cases referred to, such as Karachi and many other places where there has been complete success, the disease has again broken out on the people returning, and there have been two, three or even four outbreaks afterwards; how is that to be accounted for?—I should say it is on account of the construction of the houses, either by re-infection of new arrivals, or by the measures not having been thorough in regard to the cleansing and disinfection of the house. It was intended to destroy the worst houses but this was found to be impracticable.

26,683. After all this trouble in large towns—as in Poona, for example—has been taken and much expense incurred resulting in a successful suppression of the outbreak, if an outbreak occurs again because of infection from some other place, that shows that in order to eradicate plague altogether, it is very necessary that the other infected places should be treated in the same way, does it not?—Certainly.

26,684. If there be one infected place within probable communication, which is not dealt with in this—in your opinion—the only effective manner, then re-infection may at any time occur?—Yes.

26,685. And the work that has been done will be thrown away?—Yes.

26,686. With regard to this question of evacuation, I suppose you appreciate that the process of evacuation may itself sometimes extend plague by the people not being entirely in hand and running away to non-infected places?—That was one of the difficulties, and it was met by surrounding the section of the town to be evacuated, either with troops or police.

26,687. That may not be absolutely effective because people break the cordon?—They have done so, undoubtedly.

26,688. But even if they have done so, it is much better that the plague should have been reduced by the measures that have been taken than that it should have been left to itself or only inadequate measures adopted?—Yes. Evacuation of the locality was the first measure to be carried out. If those evacuated could not for any reason be properly segregated, the disease would doubtless in many instances be communicated elsewhere. Evacuation and segregation would, if possible, be enforced in the new centres. Latterly, when the disease first appeared in towns, the people were allowed to leave the place.

26,689. Your views are clear and decided, but have they been entirely carried out?—I think they have.

26,690. Did you make any special inquiry as to how plague was introduced into India?—Yes, but the results were not satisfactory; nothing authentic could be ascertained.

26,691. It was first introduced into Bombay?—Yes, the idea was that pilgrims from Garhwal had introduced it into the city. They came from Garhwal where mahamari was believed to be present.

26,692. How long does it take to travel between the two places?—It depends upon what part they come from. By the railway it would take three days and nights.

26,693. Do many pilgrims or other people travel from that district by railway?—They prefer to travel by rail. Any people who were going to Bombay would go by rail.

26,694. And you say they do go to Bombay?—Yes.

26,695. Therefore, an infected person might arrive in Bombay three days after leaving Garhwal?—No; because he has to travel down by road from Garhwal to the train. There was absolutely no clear evidence of its introduction from Garhwal.

26,696. How long would they take from the part nearest the railway to get to the railway?—A week or 10 days.

26,697. Before they reached the railway from the nearest part?—Not the nearest part, in Garhwal.

26,698. A week or so?—About a week. I do not know much about Garhwal. There were no reported cases of plague in Garhwal at the time.

26,699. It would take seven days to go to the railway alone?—Yes.

26,700. And another three days to go to Bombay?—Yes, it would probably take more than three days to go to Bombay, because the travellers would probably break the journey to prepare their meals, and, perhaps, visit certain holy places *en route*.

26,701. What do you think of the possible importation from China?—I think that it is a very probable source.

26,702. Have you any suspicion with regard to the Caspian Sea?—No, there is no proof of it coming in that way. We heard of no plague at the time, and there are no people coming from the Caspian Sea to Bombay, except Mecca pilgrims. There is constant traffic between China and Bombay.

26,703. Is there any direct communication between Calcutta and China?—Yes.

26,704. Assuming that China was the source of the infection, how do you account for Calcutta having been almost free from plague?—I do not know.

26,705. Have you had much experience of the effects of inoculation?—Only the returns sent by Monsieur Haffkine.

26,706. You have studied these?—I have. They were satisfactory so far as they went. They were considered so satisfactory that the Government of India directed the Government of Bombay to give Monsieur Haffkine every facility for carrying out voluntary inoculation.

26,707. Your experience may also have allowed you to come to some conclusion as to the efficiency of inoculation as a plague measure in stopping the progress of plague or extinguishing it?—It was hoped that these inoculations would, for a time at least, secure immunity to the individuals, and, if so, the progress of plague would, under certain circumstances, be arrested, or its virulence materially modified. Inoculations would then greatly simplify the measures adopted by the Government of India.

26,708. Supposing that inoculation failed as an actual measure for eradicating plague, what, then, would you fall back upon now—have you formed any opinion upon that?—With early information regarding the presence of the disease, evacuation, segregation, and the other measures adopted will prove effective: without such information, difficulty will always be experienced in the case of large towns.

26,709. You state that it seems to prevail very largely, if not chiefly, in the most insanitary quarters of the town?—Yes.

26,710. To what extent do you think the removal of these insanitary conditions might make plague impossible?—I believe that plague cannot appear and spread if the locality is in a proper sanitary condition.

26,711. Therefore, it would be the most effective of all measures?—Yes, the most effective. The Bombay Municipal Bill, if carried, should place that city in a good sanitary condition.

26,712. That Bill would have to be extended to a large number of other towns?—Yes, to the whole of India, undoubtedly. I believe that the extinction of plague and the prevention of recurrence depends upon sanitation.

26,713. Therefore, you would hail, no doubt, with pleasure, any steps which could be adopted to permanently—not temporarily in a panic merely—but permanently and continuously uphold the sanitary condition of India?—Certainly.

26,714. (*Prof. Wright.*) Were you impressed with the infectivity of the plague in Bombay when you made this inquiry?—No.

26,715. Did you form an impression that the plague was not an infective disease?—I formed the opinion from personal observation and from the other sources of information that plague was not a very infectious disease, and that there was, practically, very little danger in visiting an infected locality or in attending on the sick.

26,716. You mean that the bacillus cannot pass from one person to another?—That is so under ordinary circumstances.

26,717. Then do you regard plague as infective only in the sense that tape-worm is infective? In other words, do you think that the plague bacillus becomes infectious only after it has lived for some time outside the body?—No, I do not go to that extent. I say there was no danger in going into an infected house—practically, no danger.

26,718. Then why do you propose to isolate the people and get the people out of their houses?—There is danger in the locality.

26,719. Do you approve of the sick man being taken out of his house?—Yes.

26,720. Then are you of opinion that the sick person is a danger to his neighbours?—There is a danger to other people in his expectorations.

26,721. Then a man may be directly the cause of infection to other people?—Yes, but not in the same sense.

26,722. I want to understand the distinction that you draw. Many are of opinion that the plague bacillus passes directly from one man to another?—I do not know much about that. We found that if a man scratched himself, or had an abrasion, and happened to get the bacilli there by handling the corpse at *post-mortem* examinations, or by opening the bubo, there was the possibility of his getting the plague in that way, or from the expectorations of the patient.

26,723. Does not that bring plague into the category of infectious diseases?—Yes, it is an infectious disease because it may be conveyed by the clothing. I never denied that it was infectious.

26,724. I understood that you differed from the general opinion in respect to that. In other words, I understood that you thought a man could not be directly a source of infection to other people?—Not in the same way as scarlet fever.

26,725. Not in the same degree you mean?—Yes. I said, practically, it was not infectious in that way, that is, you can handle the patients, but if you have a patient lying in a room expectorating there is danger in the locality. His friends must attend upon him. At one time I said, "All right, if there are these "obstructions to the measures, let the patient and his "friends live in the house and die there if necessary, "but get the other people out." Every thing has proved that it is infectious to a certain extent.

26,726. Do you think you have any means in India for getting information of the introduction of an infectious disease into a town?—It is absolutely impossible to get early information.

26,727. Do you think any measures ought to be taken for getting this early information?—Yes.

26,728. What measures? Do you recommend the use of search parties?—I recommend employing the natives.

26,729. Do you mean that the natives are to be paid as spies?—No.

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26,730. You mean that they are to be employed as voluntary agents?—Yes, we divide each town into sections and put them under natives.

26,731. Is that an efficacious manner of obtaining information of infectious disease?—It was the only method we could adopt at the time.

26,732. Do you think that infective disease will never be successfully combated until you get a system of death registration?—That is so.

26,733. And until you ascertain the causes of death?—Yes, but that is practically impossible.

26,734. Ought not that to be put in the fore-front of all plague measures?—Yes, but look what an enormous expense it would be; how could you do it? Where would you get the medical officers?

26,735. Do you think there would be any difficulty in ascertaining the cause of death in Bombay in a period when there was no epidemic—say, when the plague mortality declines in summer?—Yes.

26,736. Do you think there would be any difficulty in examining 60 corpses a day?—No, I do not think so, but the difficulty is in getting the report of the deaths; they are not always reported.

26,737. Do you think it would be possible to pass laws and make it penal to move or to dispose of corpses before they had been examined?—I think it would be very difficult to do that.

26,738. Do you think it is only playing with plague to attempt to deal with it without introducing corpse inspection? I am right, am I not, when I say that in Bombay they have been fighting plague for years and that they have not yet introduced that measure?—That is the cardinal measure, before sanitary and preventive measures if you can get it. Of course our difficulty was how we could do it.

26,739. Have you seen the system of corpse inspection worked in Poona?—No.

26,740. Have you seen it worked anywhere?—No.

26,741. In Karachi?—No.

26,742. Was it after your day that they had corpse inspection there?—Yes.

26,743. You do not recommend corpse inspection?—No.

26,744. Do you know whether corpse inspection has led to disturbances?—I think it was only applied in Poona as far as I remember, and the natives were utterly disheartened in Poona. The danger was in extending a measure of that kind to the North West Provinces and the Punjab. Up-country people would not stand it. Then, again, what would you do with a pneumonic case if you had corpse inspection?

23,745. Do you think corpse inspection might be assisted by bacteriological observations in cases of that sort?—Yes, but you are not supposed to touch corpses after the death ceremonies are performed. Before the washing process takes place you can do it probably, but you would certainly now and again get a person who would not allow you to look at the corpse, especially if it were the corpse of a woman.

26,746. Do you think that a provision for ascertaining the cause of death should be put in the fore-front of all regulations when it is a question of ascertaining when an infectious disease comes to a new town?—We could not do that. That would not be part of the scheme for ascertaining the cause of death.

26,747. You think that corpse-inspection ought not to be included in your scheme of discovery?—No.

26,748. You would not recommend any system of corpse-inspection or death registration as a plague measure?—I would have no inspection of corpses as a method of detecting the cause of death, knowing, as I do, the feelings of the people in regard to any such measure, but a system of death registration would be valuable.

26,749. You would rather go on under the present system?—Yes, with medical officers to certify to each death.

26,750. How do you propose to work the death registration without corpse inspection? Whose certificate would you take?—The certificate of a medical officer.

26,751. Do you mean a Commissioned Medical Officer?—Of any medical officer.

26,752. Would you take a native's certificate?—I would take the certificates of natives of a certain class.

26,753. Would you take the certificates of unqualified natives?—Not in that way, not for a perfect death registration.

26,754. Would you recommend, as a measure for fighting plague that a system should now be introduced which would ensure efficient death registration?—Yes. That is the principal thing, if you can show a practical way of doing it.

26,755. From your knowledge of India, do you think it would be impracticable to introduce a system of registration?—Our great difficulty was to obtain a report of deaths. Death registration is possible but hardly practicable in a country like India. It could be introduced into towns.

26,756. Do you recommend this as one of the essential things?—Yes, to get early information of the deaths.

26,757. There are many ways. Search parties is one way. Do you like that system?—No, I do not like that.

26,758. Do you think death registration is better?—Yes, if you can get it.

26,759. And in default of death registration you believe in inspection of the body?—Yes, certainly.

26,760. What certificates would you take as to the cause of death?—That of a duly qualified medical practitioner, either with an Indian or an English qualification.

26,761. Do you think you can trust the certificates of native practitioners?—I think you could trust the Assistant Surgeon class.

26,762. You would trust the medical certificate of a native?—I have always depended on them thoroughly.

26,763. Is it inconsistent, with what you know of the native practitioner, to suppose that cases of plague would be reported as measles, whooping cough, or something of that sort?—We get individual cases of that kind.

26,764. Do you think that that would be largely done?—I am inclined to place perfect confidence in the certificates of the Assistant Surgeon class.

26,765. You, then, would accept certificates only from the Assistant Surgeon class?—Yes, that is a very good class.

26,766. You would take their certificates?—Yes.

26,767. You would have to make some hard and fast rule, would you not?—Yes, but you get very good men amongst that class of local officers, and I think you could take their certificates.

23,768. Would you then propose to leave it to the discretion of the Medical Officer of Health to determine in each case what certificates he would take?—Yes, I would do that; I would make him responsible as he is the responsible officer, but I certainly would accept every certificate from the Assistant Surgeon class.

23,769. You would take every certificate from the Assistant Surgeon class as unquestionable?—Yes, until I found it was wrong.

26,770. Supposing, under those circumstances, you found that plague existed in a town and was not reported to you?—I should say, therefore, that the certificates must be wrong.

26,771. What would you do then?—I should put it into other agency, if I could get it.

26,772. Would it not be well to commence with a superior agency at first?—No, I would not do that. It would cast a slur on the native practitioner.

23,773. Would you give a Health Officer the power to inspect the corpse if he doubted the correctness of a certificate?—No.

26,774. You would not use corpse inspection in any form?—No, I would not. I would not do it as a Government measure. If he chose to do it on his own responsibility he could do it.

26,775. Do you adhere to the view in *full* knowledge of the fact that corpse inspection has been accepted quite peaceably in Poona?—In Poona the people were so frightened that you could do anything you liked with them.

26,776. (*The President.*) Why?—On account of the plague.

26,777. They were frightened?—Yes. If you tried to do anything like that in the Punjab—in Lahore, for instance—you would very soon get a disturbance.

26,778. (*Mr. Cumine.*) Poona is a large military cantonment, is it not?—Yes

26,779. When people have been evacuated, and they return secretly and sleep in their houses, do they not frequently catch plague?—I believe so.

26,780. Does not that look as if the infection lay in the cow-dung floor which they sleep upon?—My idea is that it is local infection. I do not know whether it is cow-dung or what it is, but it is something in the locality.

26,781. (*The President.*) You mean partly so, because you have said that it might be in the human being?—Yes, partly. Once it gets into a locality that becomes a fresh centre. I could not say about the cow-dung floor.

26,782. (*Mr. Cumine.*) My point was, whether it does not appear to be in the floor of the house?—I am not certain; we have no information on that point; we do not know anything about the natural history of the bacillus of plague.

26,783. Assuming, for a moment, that the infection does lie in the floor, and that the natives get it from going in with bare feet or from sleeping on the actual floor without bedsteads, would the sanitary improvements which you think are required to eradicate plague from India touch the floors?—Sanitary measures will prevent the floor and anything else becoming a source of infection, because the bacillus could not live in sanitary conditions.

26,784. Would these sanitary conditions interfere with the floor of the house?—Not necessarily.

26,785. (*The President.*) I thought you said they would, because of the fresh air and light?—Yes, in that way, but I thought you meant with regard to the floors being made of stone, lime, etc.

26,786. (*Mr. Cumine.*) Would you prescribe any particular kind of floors?—Nothing of the kind. All I would prescribe would be that the house should not be overcrowded, and that it should be built under ordinary sanitary conditions.

26,787. You would not prescribe certain sizes of windows?—No, certainly not.

26,788. (*The President.*) You would not say that there must be a certain sized window and a certain air space, but you would say they must not be smaller than a certain standard?—A decent size.

26,789. (*Mr. Cumine.*) Would you do that?—That is going into such minutiæ that it would worry the life out of the people. What I say is, have proper ventilation in the room, and then you can afford to do what you like if you have proper ventilation and proper light.

26,790. Who is going to see that that is carried out?—The Government of India or anyone else.

26,791. (*The President.*) You must have a new organisation in the whole of the Sanitary Department?—Yes, we want a new Sanitary Department.

26,792. The present Sanitary Department is scarcely able to undertake it?—It is impossible; we are merely advisers. I was merely adviser to the Government of India. I could issue no rules without their sanction, nor could I do anything without their orders.

26,793. Having regard to the vastness of the country and of the population, the present organisation is insufficient to maintain India in a sanitary condition?—Quite insufficient and ineffective. It is a defective organisation entirely.

26,794. I understand, from some answers you have have given, that you think that a satisfactory method of obtaining early information would be to accept the medical certificate of a man whose qualifications shall be afterwards defined, and alternately if that is not obtained, by corpse inspection?—Not corpse inspection.

26,795. You altogether disapprove of corpse inspection?—Yes.

26,796. Even though it has not caused much opposition, not only in Poona, but in other parts of India?—There are only one or two parts.

26,797. There are several parts of India in which it has been done without opposition?—Yes.

26,798. Karachi certainly, and Belgaum, and two or three other places where they are carrying it out: the people have got accustomed to it, and now that they know what it means they do not oppose it so much. At all events, if corpse inspection could be done in a manner that would not cause serious opposition, you would not object to it?—Then I say, what is the object of corpse inspection?

26,799. Supposing you cannot get a medical certificate from a man whose qualifications you would be willing to accept?—I say that corpse inspection is useless to discover the disease, because you cannot find out the pneumonic form of the disease by corpse inspection.

26,800. But, supposing the number of pneumonic cases is small relatively to the bubonic cases, as it generally is, and the bubonic cases are discoverable, is it not something to discover part of the cases, if not all?—Of course, if you can do it.

26,801. (*Mr. Cumine.*) The President asked you to suppose that corpse inspection could be done in a manner that would not cause serious opposition, and then asked if you would approve of it. But that supposition is one that you find it impossible to make, I understand?—With regard to up-country, yes. I think it would give rise to great opposition. I have have always held that opinion. My idea is that if that measure were imposed on the people up-country, it would certainly not be worth the opposition it would give rise to.

26,802. You said that where the Collector was a good officer he would manage to get all the people out of an infected town very readily?—I think so. I do not mean a good officer in the sense of being a good Civil officer; I mean a man with a certain amount of individuality and tact, and a man who knew the natives. I think he could do anything he liked with them if he has their confidence.

26,803. I was going to ask you whether, though he would gladly do it one year, and ask all his people to go out one year, and they would go out one year, would he be ready to keep on asking them to go out in two or three successive years, and do you think they would continue to be willing to go out two or three years in succession?—Certainly, if the arrangements were good for housing them; but with such repetitions, the question would naturally arise as to providing new and permanent accommodation for the people.

26,804. (*Prof. Wright.*) How would you propose to find out the cause of death by medical certificate in the case of people who are not seen by a medical man?—That is difficult.

26,805. Would you have corpse inspection then?—No.

26,806. Would you let those people be buried without diagnosis?—There would always be a way of getting over it. The Medical Officer of the district in which the death had occurred would know.

26,807. You would take his certificate?—Yes, he would manage to find out by asking the people: he could see the body and see if there were signs of plague.

26,808. Would you take a relative's opinion?—No.

26,809. Would you not sooner have corpse inspection?—No, it is so distasteful to the people.

26,810. Supposing it can be done, would you not think it would then be advisable to try it in cases where you get no medical certificates?—I am not in favour of it; it is so utterly repugnant to the people when they are in a normal condition. They would not allow me to touch a corpse in the ordinary course of practice. I could not go near the body, and especially near the body of a woman—they would not allow it. I have asked all classes of Muhammadans and Hindus about it, and they all say it is utterly repugnant to their system of religion.

26,811. (*The President.*) But in some parts of India the Muhammadans have submitted to corpse inspection?—I daresay they have, either from being cowed, or seeing the hopelessness of opposition.

(Witness withdrew.)

Dr. W. J. Simpson, F.R.C.S.

6 May 1899.

Dr. W. J. SIMPSON, F.R.C.S., called and examined.

26,812. (*The President.*) You are a Doctor of Medicine?—Yes.

26,813. And you have lately been Health Officer in Calcutta?—Yes.

26,814. Within what time were you Health Officer in Calcutta?—From May 1896 to September 1897.

26,815. During that period did you see in Calcutta any cases of plague?—Yes.

26,816. When?—About the beginning of October 1896.

26,817. Would you give us a description of the cases you considered to be cases of plague?—The cases of fever and glandular enlargement in Calcutta, and which were suspected to be cases of plague, that came under my observation were as follows:

(1.) On 8th October, one case at Howrah, that of a Goanese youth, aged 17, named Cotta. He had arrived from Bombay 12 days previously. I was asked to see him by Surgeon Lieut.-Colonel Tomes. He had enlarged glands on each groin, which were tender. There was no sign of syphilitic or venereal affection. There was no history of injury. The full history of the case is given in my Annual Report for 1896, p. 18, from which I extract the following:—

"In October a case of glandular sickness with fever occurred in Howrah, in a patient who had arrived from Bombay. Surgeon Lieut.-Colonel Tomes asked me to see the case, which I did, with Dr. James, on October 8th, 1896. The patient, without any history or sign of syphilis or venereal affection, was suffering from tender buboes on each groin, and had a temperature of 102°; though perfectly sensible and intelligent, he seemed to require to be aroused before he answered any question. His eyes were somewhat suffused, and tongue furred in the centre, and red at the tip and edges, he had on his legs, arms, and body an urticarial-looking eruption, and distinct from this, on his back and shoulders, was, here and there, a reddish rash varying in size from less than a split pea to that of a bean. He had started from Bombay on the 23rd September, arriving in Howrah on the 26th, and was attacked with fever on the 28th. With careful antiseptic precautions the patient's finger was pricked, and cover-glass preparations were made. The needle of a syringe was inserted under his skin, and a small quantity of blood drawn off and inoculated into two culture tubes of nutrient agar and bouillon. With similar precautions blood and serum were taken from the glands and groin, and culture tubes inoculated. The microscopical specimens were examined the same night and found to contain diplo-bacteria.

"The next morning the patient was seen by Dr. Cobb, Dr. Tomes, and myself, and after careful examination the following notes were taken:—

"*History of Patient.*—J. C., aged 17 years, who had been living with his father, a telegraph master, residing at Bellasis Road, Byculla, Bombay, came with his sister to Howrah on a visit, and took up his residence in Ghose's Lane, Howrah.

"In Bombay, he attended the Byculla School. He left Bombay with his sister on the 23rd of September 1896, and arrived in Howrah on the 26th September. About 15 days before leaving Bombay, he noticed the gland of the left groin to be enlarged and painful, then the gland in the right groin began to enlarge, but he felt quite well until he reached Nagpur, on the 24th September, when he began to experience symptoms of malaise, loss of appetite, and the glands in the groin grew larger, and four small rounded pimples appeared on the penis. These pimples lasted for four days. He remained much about the same until his arrival in Howrah, when, on the 28th September, he was attacked with fever, which was of a remittent character, being worse at night than in the morning. He perspired profusely and suffered from severe itching, due to urticaria. The pain in the groin was of a dragging character, but did not interfere with his walking about until the last few days, when, on account of the discomfort in the groin, and the heaviness in his head, he was obliged to take to his bed. The sister of the patient stated that she was well acquainted with the plague, as she had seen several cases while in Bombay.

"On examination of the patient on October 9th, his countenance appeared heavy, and there were dark hollows around the eyes. His tongue was covered with a whitish fur in the centre, the edges being red. His conjunctivæ were slightly congested. He seemed dull and apathetic in answering questions. His head was hot to the touch. Patches of urticaria, varying in size from a pea to a bean, were scattered over the back, forearm, and legs. There were also some small reddish patches which disappeared on pressure, and which varied in size from a pea to that of a four anna piece or larger, on the skin of back and shoulders. These were not observed on any other part of the body. In the right groin was an enlarged gland, the size of a hen's egg. It was situated above Poupart's ligament. It was hard and slightly tender. In the left groin, there were two enlarged glands, one similar to that on the right side, but smaller; another, the size of a small marble, was situated below Poupart's ligament, and was more tender than the others. The penis was carefully examined and found to be free from sores. On inquiry, the patient denied that he had ever had syphilis. The spleen, liver, heart, and lungs were examined and found to be healthy. There was no sore throat. There were no other enlarged glands in the body. The patient stated that the bowels were regular and urine natural. Pulse 110. Temperature 99·6 in mouth. Blood was taken from the finger and examined at the laboratory.

"After a prolonged consultation, Dr. Tomes, Dr. Cobb, and myself, came to the conclusion it was a case of *pestis ambulans*.

"The Medical Board,* investigating the case later on, came to the conclusion that there was no evidence to consider this a case of true bubonic plague."

26,818. Of whom did the Medical Board consist?—Mr. H. H. Risley, Secretary to the Government of Bengal, in the Municipal and Medical Department; Mr. J. G. H. Glass, Secretary to the Government Public Works Department; Dr. G. C. Ross, Inspector-General of Civil Hospitals; Mr. P. Playfair, Sheriff of Calcutta; Dr. D. D. Cunningham, Professor of Physiology, Medical College; Dr. H. J. Dyson, Sanitary Commissioner, Bengal.

26,819. Your microscopical examination was restricted to a determination of the morphological characteristics?—Yes, at that time.

26,820. And at any other time?—Later cultures were made from some of the blood which was taken from the groin. In slide specimens prepared from the blood of Cotta, some of the Shropshire cases, Tincauri Pal, Grace Hodges, Heman Shah, Surendra Nandi, Giga, Bepin, Golab, and the rats suffering from glandular sickness, there were bacteria of a diplo-bacterial character, and morphologically similar to the specimens of plague in man and rats from Bombay.

26,821. I understand you did more than that?—From Cotta a comparatively pure specimen was obtained, which afterwards became contaminated. Sub-cultures were made from Cotta, which were taken from the blood.

26,822. While he was alive?—Yes.

26,823. At what period in the illness?—It must have been about three weeks after the glands began to enlarge.

26,824. Late in the disease therefore?—Yes.

26,825. Was he convalescent?—He was not convalescent.

26,826. Was he pyrexic?—Yes, he had a temperature of 102° at that time.

26,827. Your cultures became contaminated, I understand?—Yes.

26,828. Could you draw any conclusions from these contaminated cultures?—No.

26,829. Did you have other cultures from this man which were not contaminated?—The first cultures appeared to be contaminated, and then later, the microbe, or what appeared to be the microbe, was isolated, but after passing this through several generations this microbe, which seemed to be pure at first, ultimately became contaminated.

26,830. Did you do that in a culture medium?—Yes.

26,831. Will you describe the character of the culture, its appearances, and in what you cultivated the microbe?—I cultivated it first of all in bouillon and agar. It was a bouillon culture which ultimately became contaminated.

* *See* App. No. XXI. in Vol. I. of these Proceedings.

I had, as standard specimens, cultures from Bombay brought to me by Dr. Dutt. I sent my assistant, Dr. Dutt, to Bombay, at the time of the outbreak of the plague there. He worked with M. Haffkine for a short time, and M. Haffkine was kind enough to give him cultures obtained and prepared from plague patients. Dr. Dutt also brought cultures from plague patients which he had himself prepared in Bombay. Then he brought me also Dr. Surveyor's cultures from plague affected rats in Bombay. Cotta's cultures appeared in many respects very much like the cultures that Dr. Surveyor had made from the rats.

26,832. What do you regard as the distinguishing character of the cultures in the case of the true plague microbe?—At that time we did not know so much as we do now. Haffkine's test method was not in existence, and we had simply to go by the morphological appearance under the microscope, and the bluish whitish appearance of the growth on the agar. We had nothing further to go by at the time.

26,833. Did you make any experiments on animals with regard to the toxicity of any of the substances or products obtained from Cotta?—Yes. I am confining my observations to the case of Cotta. I inoculated a guinea-pig with the cultures.

26,834. That is when you got it in a pure form differentiated from the other organisms?—Yes, I inoculated it into a guinea-pig, which was about 500 grammes in weight.

26,835. How much did you inoculate?—Into the guinea-pig 1 c.c. was injected into the peritoneum. 1 c.c. was also injected into the peritoneum of a mouse. The guinea-pig died in four days time, and the mouse died in 30 hours. Similar doses were injected subcutaneously into a guinea-pig and a rat of the same weight, and the only result was loss of weight.

26,836. In all these experiments?—In Cotta's case.

26,837. Do I understand that you injected the products from Cotta into several guinea-pigs and several rats?—Yes.

26,838. And in each case they recovered?—Yes, when injected subcutaneously.

26,839. Did you make any intra-peritoneal injections also?—None, other than those mentioned.

26,840. Only subcutaneously?—Yes.

26,841. The experiments appear to show that it was not an active virus?—It showed it was not an active virus.

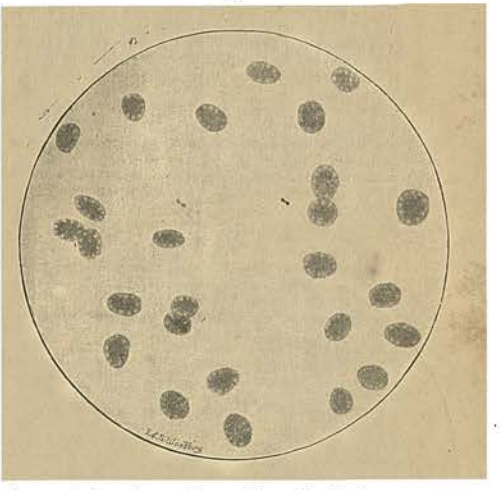
26,842. And 1 c.c. is a large quantity, is it not?—Yes, it is an enormous quantity.

26,843. Will you proceed to the next case?—The next case brought to my attention was on the 10th October. Surgeon-Lieutenant Cobb showed me a letter from Surgeon-Major Skinner, which was as follows:—"The case of *pestis ambulans* published in "to-day's paper has aroused our curiosity to know "more about it. Among the soldiers, for certainly "a year past, we have had cases of fever, followed, or "preceded, or accompanied by enlargement of glands "in the groin. There has been no suspicion of "venereal origin. A lad will sometimes come into "hospital with malarial fever, which will run its "course, leaving him cachectic; while being treated "for the cachexia he will grow a bubo. Sometimes a "a man comes in with a non-venereal and non-infected "(*i.e.*, by sepsis) bubo with fever. These buboes will "suppurate in a sluggish manner, and take a long "time to get well. We call them malarial buboes. "When I had dysentery in July last I got small "buboes on both groins. The glands here are still "perceptible, as also in both axillæ. How is one to "diagnose between these cases and a case such as "that of Cotta, reported in to-day's paper? I may "add that, before I came to Calcutta, the above cases "were looked upon as venereal, though without vene-"real origin. It was only when I drew particular "attention to them that they were recognised as non-"venereal." A few days after this I visited the Military Hospital with Dr. Cobb and saw 10 cases belonging to the Shropshire Regiment. The Shropshire Regiment arrived in Calcutta in January 1895 from Hong Kong.

26,844. You say the cases were in October 1896?—Yes.

26,845. The Shropshire Regiment arrived in Calcutta in 1895?—Yes, in January 1895. Dr. Cobb had visited these cases previously and taken from a number of cases specimens of blood from the finger. He came to my laboratory. The specimens were stained immediately, and in a number of them these were diplobacteria of a kind. For example, I have here a drawing (No. 1.) of one which was taken from the

I.



microscopical specimen; it was drawn by Professor Cunningham's draughtsman. I have some others also (*handed to the President*).

26,846. Was anything further done in the microscopical examination besides determining the morphological characteristics?—That is the result of Dr. Cobb taking these specimens. Then I visited the hospital with Dr. Cobb.

26,847. (*Prof. Wright.*) These were specimens taken by Dr. Cobb?—Yes.

26,848. Were they stained by you or stained by him?—I could not exactly state whether they were stained by him or by myself.

26,849. Do you remember how they were stained? That *is* the point?—They were stained in my laboratory; and I was with him.

26,850. What dye were they stained with?—I think they were stained with methylene blue. Some were stained with eosin.

26,851. Dr. Cobb stained several of them, and you stained the others?—Yes.

26,852. Were the morphological characteristics the same in both?—Yes, they were the same.

26,853. Was there any other examination?—Yes. A few days afterwards I went with Dr. Cobb, to the Military Hospital, and, with the permission of Major Skinner, took some blood from two of the patients there. The method adopted was as follows:—I used a hypodermic syringe. I took out the ram of the hypodermic syringe, and attached some gutta-percha tubing to the barrel of the syringe. I thoroughly boiled this apparatus, and then inserted it into the basilic vein, and drew blood into some tubes containing bouillon and into others containing nutrient agar. I took about 12 tubes from each of the two cases, and in a few days—about three days—there were growths in some of them; and in others there were no growths. I isolated these growths, one from the man Rabbid and another from Finney. Those were the names of the soldiers. The one from Rabbid grew very slowly, in single colonies, in different parts of the agar when I transferred it. The growth was exceedingly slow, but morphologically it showed diplobacteria under the microscope. Finney's, at times, morphologically showed diplo-bacteria, which at other times developed into chains, but at other times grew

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very irregularly, and I cannot say whether they were involution forms or contaminations.

26,854. You got these cultures from the second man, Finney?—Yes.

26,855. Did you only draw off blood on one occasion?—Yes.

26,856. (*The President.*) What do you mean by saying that at times such and such a thing occurred, and at other times something else? Do you mean in different or in the same cultures?—Yes, they did not seem to act always in the same way; so much so that I thought there must be contaminations. Sometimes the irregular growths reverted to this diplo-bacterial character again.

26,857. Do you mean in the same specimen?—Yes, after passing through several generations.

26,858. (*Prof. Wright.*) Have you any drawings to illustrate this?—That (No. 2) is only the slide specimen

II.

I have. The reason I have not a drawing of Finney's case was that I sent the specimen then, along with others, to Dr. Havelock Charles, who was going home through Japan, and who was kind enough to take them to show to Kitasato, to get his opinion upon them.

26,859. Dr. Charles told us in Calcutta that he had submitted the specimen to Kitasato, and Kitasato said they were diplo-bacilli?—I did not know that Dr. Charles had given evidence on this point. I injected the cultures from Finney and Rabbid subcutaneously into guinea-pigs and rats, but they produced no effect whatever.

26,860. (*The President.*) And in large quantities?—Sometimes as much as 2 c.c.

26,861. Do you recollect in what period of the disease the blood of these specimens had been drawn from these two soldiers?—I do not know how long they had been in hospital. I suppose they might have been in hospital three weeks.

26,862. Do you know if they were suffering from any acute symptoms at the time?—They were in bed.

26,863. Do you know if they had a temperature above the normal?—No, I do not.

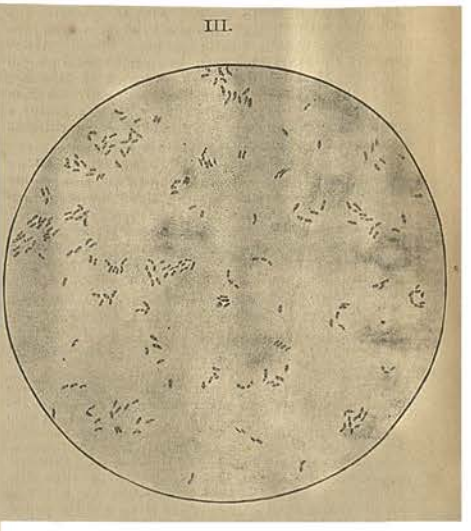
26,864. You have noted the glands which were affected, have you not?—They were in the groin.

26,865. In both groins in each case?—I am not certain.

26,866. But at any rate in the groin?—Yes.

26,867. Is there anything more you wish to say about these cases?—This (No. 3) is a drawing of diplo-

III.



bacteria from the man Rabbid (*handed to President*). It was drawn by the same man who drew the others.

26,868. Would you go on to the next case?—In the second week of October three cases of fever with glandular enlargement were reported to me among children. The names of the children were Tincauri Pal, aged 14, who worked at a jeweller's in Kansaripara Bhawanipur, and who had a considerable dealing with the Marwaris; Grace Hodges, aged seven, whose father was a Custom-house officer, and who lived in Chattawai Gali, Bowbazar, the case was reported by the authorities at the Medical College; and Heman Shah, aged 12, by trade a hawker, living in Jaunbazar Busti, Fenwick Ward. The history of these cases is as follows:—Tincauri Pal, aged 14, lived at Elgin Road, Calcutta. He was apprenticed to a jeweller living at Kansaripara, Bhawanipur. He began to be ill on 5th October with fever. For four or five days previous to this he had had ulcers on his tongue. I described the case at the time with great minuteness, because there was no certainty as to what they were, and I thought it desirable to record exactly what was seen.

26,869. There was no suspicion of these ulcers being syphilitic, was there?—Oh, no. On the 6th October he attended the Bhawanipur Hospital. He had no pain then. On the same day he noticed a swelling in the left groin, and it was painful and tender on pressure. On the 8th, the temperature was 103°, on the 9th, 104, on the 10th, 104°. When the fever rose he had headache in the temples. On the night of October 9th he was delirious.

"*Present Condition.*—On 10th October, afternoon, temperature 104°, pulse 98, tongue furred in centre, a portion of the epithelial lining of the front of palate denuded in patches. A purple coloured rash, varying in size from that of a split pea to that of an eight anna piece, thickly studded on back. Patient's friends state that urine first passed was yellow, and that last passed, colourless. Bowels said to be natural. A bulla on left leg about the size of a two-anna piece. On left groin were three glandular enlargements, one the size of an egg, the second slightly smaller, and just below Poupart's ligament, and the third below these, and the size of a marble; on the right side one of the glands below Poupart's ligament is slightly enlarged. Face somewhat pale, eyes slightly congested, perspires profusely." Blood was taken from the finger, and on examination was found to contain diplo-bacteria. I say 'found to contain diplo-bacteria.' I might have to search half-a-dozen slides before I found them. Diplo-bacteria were not there in numbers. My method of preparing the slides was as follows:—I always had slides prepared in the laboratory, and then put into alcohol. In this case

I washed the finger thoroughly first with soap and water.

26,870. And nothing more?—No. After that I swabbed it with a solution of carbolic acid, and then with a little alcohol, and then pricked the finger, and with a sterilised needle spread the blood over the whole slide, dried the specimens thus made, and then put them into a box and took them to the laboratory at once and examined them.

26,871. Then there was the chance of contamination, was there not? The actual blood was not in any way covered except by being put into the box?—Not in this case. I stained it in the manner already described, and found a similar organism to that I had previously found in the other.

26,872. Do you know what the after-history of this case was?—He went to the hospital and got rapidly well. The Medical Board saw him after a few days, and came to the conclusion that it was not a suspicious case.

26,873. Did the enlarged glands suppurate, or did the enlargements simply become absorbed?—They became absorbed.

26,874. Did you do anything else in the examination of the blood?—No, not in this or the next three cases; they were merely slide specimens.

26,875. Will you give us the next case?—The next case was Grace Hodges. The history was as follows:—On 8th of October she complained of feeling ill, with pains all over the body. On the 9th October she complained of pains in the groins and fever. On examination her mother found the glands in the groin enlarged, and also those of the neck. On the same day the mother took her to Chandni Hospital, where the doctor found the glands in the axilla enlarged, and the temperature of the child was 99°. The Chandni Hospital doctor told the mother it was a suspicious case. Afterwards the doctor wrote a letter stating that he thought this was a syphilitic case. On the evening of the 9th the temperature rose to 102°, but the next day (10th October) after a dose of castor oil, the child seemed better. On the morning of the 11th October she was taken to the Medical College Hospital, where she was also told that the case was a suspicious one of plague, and the Medical College authorities officially notified the case as one of suspicion to the Health Officer. On this notification Dr. Cobb visited the house, in company with Dr. Vaughan, and found the patient in a small house in a crowded locality. The child walked to an upper room, where we examined her and found the following:—

"She looked pale and weakly. Her tongue was furred in the centre and red at the edges. The breath was foul, the bowels said to be regular, eyes clear. There was no rash on the skin, there were no sores on the feet, or signs of irritation about the genitals. There were three small boils on the back and one on the side of the head behind the ear; the skin was dry, and the mother stated she had not noticed any excessive perspiration. There were three enlarged glands under the anterior folds of the right axilla, each about the size of a small marble; there were two similar ones under the anterior folds of the left axilla, and another at the apex of the left axilla. There were three enlarged glands in the left groin above Poupart's ligament, and there was a vertical chain of small enlarged femoral glands on the right side. The enlargements of the glands were more marked on the left side. The cervical glands on both sides of the neck were felt to be enlarged. Blood taken from the finger showed diplobacteria."

26,876. Why was it supposed to be a case of syphilis? What information did you receive?—I think it is stated in the letter of Dr. Panioty that he had attended the sister who had had syphilis, and the child herself had teeth which indicated hereditary syphilis.

26,877. Did you see the father or mother?—Yes.

26,878. Did you make any inquiry as to the possibility of syphilis?—No, we did not. We examined the child thoroughly.

26,879. I mean did you examine the parents?—No.

26,880. Will you give us the next case?—The fourth case was Heman Shah, a boy, aged 12 years, living at 134, Jaunbazar Street, Fenwick Bazar, who came from Monghyr four months ago. On the 10th of October he was attacked with fever, and for two days he passed loose stools, and was delirious at night. On the 12th he was seen by us; his temperature was 103. He was prostrated and complained of severe headache. He had a peculiar, apathetic, and dazed appearance, his eyes were suffused, his tongue was much coated in the centre and red at the edges, pulse was small and very soft. There were no eruptions on the skin. The inguinal glands were slightly enlarged, but not particularly tender to pressure. Blood was taken from the finger, and found to contain diplo-bacteria. On the morning of October 15th his fever was less, and he seemed to be more sensible. He was removed to hospital and, on admission, his temperature was 99. His skin was dry. There was no rash, no head symptoms, tongue moist and reddish. No pain or tenderness in the abdomen. Bowels were constipated. Slight cough, moist râles here and there in both lungs, specially at left base. Heart normal; pulse moderately full and regular; no splenic or hepatic enlargement. Lymphatic glands of neck, right axilla, and both groins were enlarged. On October 14th blood showed diplobacteria.

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26,881. Will you describe the enlargements of the glands in this case?—Some were very similar to the others. They were not very large. They were about the size of a small marble.

26,882. Were the margins of the enlargements quite definite?—No; they were somewhat suffused.

26,883. Was there any swelling surrounding the glands?—There was a slight swelling surrounding.

26,884. Where is Monghyr, where the patient came from?—It is in North-Eastern Bengal.

26,885. I ask you because I want to know whether there is any possibility of there having been plague cases in that district?—No, I do not think so. There was not much communication.

26,886. You have no knowledge of any source of infection in Monghyr?—None whatever.

26,887. Will you proceed with the fifth case?—The fifth case was S. M. N., aged 9 years, living in Old Chinsura, who was examined on the 19th October. Dr. Dutt, of Chinsura, who attended the patient, reported the case to me by mistake. It ought to have been reported to the Medical Board. The Medical Board asked that all cases of a suspicious character should be reported to them wherever they might occur, but Dr. Dutt made a mistake, thinking the report ought to be made to me. On receiving the report Dr. Cobb and I met Dr. Dutt and examined the case.

26,888. Is Chinsura a part of Calcutta?—No it is a little north of Calcutta, on the other side of the river. It is about 20 miles north of Calcutta. This is the history which Dr Dutt gave me. The boy took ill on the 5th October with strong fever and severe pains in the forehead and temples; his temperature in the axilla varying from 102 and upwards, rising on the 8th and 9th to 106. After this it fluctuated between 102 and 104. On the 10th October he became delirious; no rash was observed on the body, nor had he any attack of shivering. On the 11th October the glands in his neck, groin, and axilla, were noticed to be enlarged and tender, and they were painful. On the 13th October, Dr. Dutt found the boy's temperature to be 102·6. He noticed a dull and stupid expression on his face; the tongue covered with a whitish fur in the middle, with red tip and edges. There was no sore throat. The glands of the neck were swollen on the right side specially, particularly the chain of glands behind the sterno-mastoid muscle. At night the fever rose to 104·6, and then to 105. He was delirious, with a pulse of 128—small, weak, but regular. The heart sounds were weak, the first sound being almost inaudible. There were a few râles on the bronchi, and the breath sounds at the bases of the lung were weak. There was congestion at bases. There was no enlargement of the spleen. The liver dulness was normal. The urine was high coloured, sp. gr. 1,009, and it contained a small quantity of albumen.

"*14th October.*—Temperature 102·6 in the morning, evening temperature 103·5. The boy complained of pain in the left axilla, but no swelling was perceptible; he was much worse in every way. Pulse 130 to 135,

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and respiration 55 to 60. Dr. Dutt, at this period, feared a fatal issue.

"*15th October.*—The glands in the right axilla became painful on this day. Dr. Vaughan saw the patient, and took some blood from the finger. Morning temperature was 102·6, the evening temperature 104.

"From the 15th to the 19th October there has been a gradual improvement, the fever and the glandular swelling gradually subsiding, but the patient remains in a very weak state. Present condition, as recorded by *Dr.* Cobb, who made the medical examination: The child was lying on his back in a weak and exhausted condition, with a peculiar dull and apathetic look on his face. The eyes were sunken with dark hollows round them. The conjunctivæ were not congested. Tongue covered with a white fur in the centre with red tip and edges. Pulse was 120. Temperature 100·6 in the mouth. Respiration, 50 per minute.

"*Lungs on Percussion.*—The sounds were normal except at the right base, where there was some loss of resonance.

"*On Auscultation*, bronchial and crepitant râles were heard at both bases, and there was bronchial breathing at the right. Liver and spleen were normal in size.

"*The abdomen* was somewhat distended; there was no sore on the penis or prepuce.

"*Right Groin.*—One inguinal gland was found to be enlarged to the size of a betel nut; it was surrounded by three smaller glands, one being femoral.

"*Left Groin.*—There were four enlarged inguinal, and one femoral gland in this situation.

"The deep *lumbar* glands were felt to be enlarged.

"*Neck.*—The chain of lymphatic glands at the back of the stern-mastoid muscle on the right side were felt to be enlarged, as also were some of the glands in the front of that muscle.

"In the *left axilla*, a gland of the size of a large bean was felt in front of the posterior fold.

"In the *right axilla*, a small gland was felt in the inner side behind the anterior fold."

Blood was taken from the median-basilic vein, and found to contain diplo-bacteria.

26,889. Was that on the first occasion or on the second occasion?—On the second occasion. Blood was also taken by Dr. Vaughan.

26,890. (*Prof. Wright.*) Was that only a cover-glass specimen?—Yes; I took blood from the median-basilic vein; but, unfortunately, I used a syringe, which had been sterilised, and had been used for the anti-cholera inoculine. After filling the syringe and when putting some of the blood into the culture media, it was distinctly noticed that the syringe was defective, and that air was being injected into the tubes as well as blood. I had half-a-dozen cultures, and one of those I sent to Dr. Cunningham at once; the other five were retained. In a few days I discovered the whole of these were contaminated. They certainly had aërial organisms in them. I informed Dr. Cunningham of the matter, and it is one of those cases which he mentions in his report where there was contamination. These were the circumstances.

26,891. (*The President.*) That examination was not satisfactory?—It was not satisfactory.

26,892. Will you proceed to the next case?—On the 20th October, the death of a woman, named Golab, was reported to me by one of my inspectors and by the police. I went to inspect the body before it was burnt, and was accompanied by Captain Vaughan and two of my medical assistants. On inquiry, we found that she had suffered from high fever, and from swelling of the glands on one side of the neck. These were not parotid glands. On inspection, we found no swelling in the groins, but a swelling of the glands on one side of the neck. Blood was drawn by a sterilised hypodermic syringe from the heart, which was found to contain large numbers of diplo-bacteria, but as all the cultures were much contaminated, no decided opinion was formed at the time. After seeing similar cases in Poona, I am satisfied that this was a case of plague.

26,893. What was the cause of the contamination?—The body had been lying there for a few hours before we reached the place.

26,894. So far as the bacteriological examination was concerned the result was nil?—Yes, it was nil.

26,895. Then will you give us the seventh case?—On the 1st November, a child named Giga, aged about 4 years, the son of a Marwari, living at 13, Armenian Street, was reported to me by Major Charles, Professor of Anatomy at the Medical College, and Second Surgeon to the Hospital, as being a suspicious case of plague. The following history was given me by Dr. Charles:—"Ill about 10 days; fever and slight "bronchial catarrh; glands of left axilla enlarged to "the size of small marbles; those of right axilla "enlarged, but less so. Glands of right groin palpable; "one gland in left groin inflamed, and will suppurate, "sub-occipital glands can be felt, but do not count, as "child has had eczema of the auricles." I thought I had his letter, but this is a quotation from the letter.

The gland was opened and pus and blood specimens taken, and diplo-bacteria were found in the groin. The microbe could not, however, be isolated, owing to contamination; the reason being that the abscess was opened in the room before any precaution had been taken. The people in the house were Marwaris, who received goods, clothing, and yarns from Bombay. On inspection of the warehouse below, in which the child Giga was accustomed to play, a rat was found, sitting on the step, looking very ill. It did not attempt to escape, and seemed to be in a dazed condition. The rat was taken to the laboratory, killed there, and immediately examined. Its glands in the left groin were found to be enlarged, congested, and agglutinated together. The internal organs were generally congested; diplo-bacteria were found in the blood and internal organs, and cultures from these gave growths resembling specimens of plague bacilli in rats received from Bombay. Healthy rats were examined, but no bacilli were found in their organs. I examined at that time seven healthy rats from other parts of the town. The following are notes made at the time on the condition of the rat suffering from glandular sickness in November 1896 in Calcutta:—

"*1st November* 1896.—Rat from 13, Armenian Street, found ill, furred coat, eyes dull and watery, seemed to be unable to move freely, did not run away when approached by people. Killed at 1 p.m. Blood, when examined, found to contain diplo-bacteria and large coccoid bacteria. On deflecting the skin, the glands, in both inguinal and axillary regions, much enlarged and inflamed. Spleen enlarged, liver enlarged and soft, heart dark in colour, kidneys enlarged and congested, blood very watery, lungs light grey with darker patches. Bouillon and agar inoculated with blood from heart, spleen and liver. In two days bouillon and agar showed diplo-bacteria similar to those in the specimens in the rat.

"*3rd and 4th November.*—Seven healthy rats examined, and microscopic specimens made from heart, liver, and spleen. No microbes observed in the specimens. Cultures from five show no growths, cultures from two show micrococci and bacillus subtilis." It was found that the enlarged glands and the organs were filled with diplo-bacteria.

26,896. Could you give us any particulars of the appearance of the growths in the agar and bouillon cultures?—The appearance of the growths was in bouillon slightly granular, and on agar bluish white colonies. At first they grew much more rapidly, apparently, than those which I have been speaking of, and much more luxuriantly. Under the microscope a number of them had a coccoid form, but were much smaller than in the specimens I had received at Bombay—M. Haffkine's specimens. They were smaller, but that was the only difference I could see.

26,897. Did you take any steps to ascertain whether any of these cocci were pathogenic?—No, unfortunately, I did not. I did cut off part of the organs of this rat and let other rats eat the pieces, but no result followed.

26,898. Will you give us the eighth case?—A week later there was an outbreak of glandular sickness, with great mortality, among rats in two houses in the Marwari quarter. It was reported to me by the inspector of the special cleansing gang working in Jorabagan that within a few days there had been an unusual mortality among rats in two grain shops in Burtolla Street.

26,899. Is this quarter near Armenian Street?—Yes, just a little north of Armenian Street.

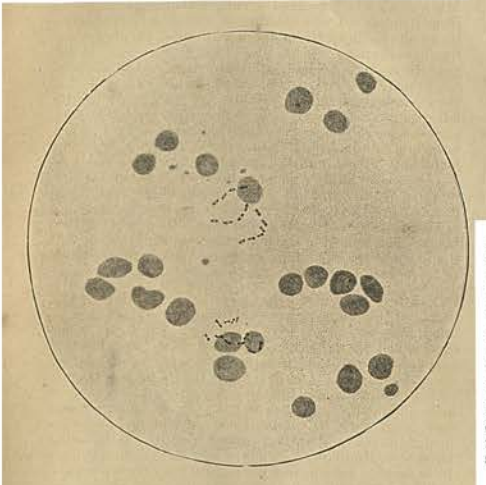
26,900. Therefore, these houses were near 13, Armenian Street?—They were not near; they were separated by at least three streets.

26,901. Do you know if these people had any intercommunication with the people in Armenian Street?—I do not think so.

26,902. Did you inquire into that?—I did not.

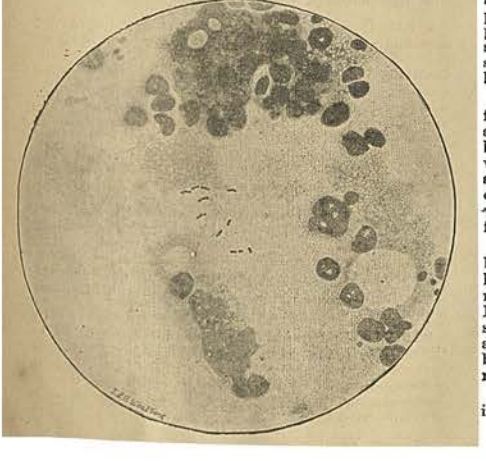
26,903. Will you proceed?—Dr. Cobb and I visited the two grain depôts, 81 and 14, Burtolla Street, and saw nine sick rats and eight dead in 81, Burtolla Street, and one sick rat in 14, Burtolla Street. 14, Burtolla Street is nearly opposite No. 81. Some sick rats were taken to the laboratory and examined, with the same result as that obtained from the rat in 13, Armenian Street. This (No. 4) is the drawing of the

IV.



diplo-bacteria in the spleen of one of them; this (No. 5)

V.



of the diplo-bacteria in the liver of another; and here (No. 6) is the drawing of the plague bacillus in the

VI.

gland of a rat in Bombay which was sent to me. Steps were taken to have No. 81, Burtolla Street closed. Meanwhile, the number of deaths among the rats was recorded, the mortality in 81, Burtolla Street reaching in one day to 100. The floors were dug up; the place flooded with disinfectants, and any rats found killed; after which, no further cases occurred. This history was repeated in No. 14, Burtolla Street, somewhat later, with a similar result. A few sick rats were found in adjoining houses. These houses were also thoroughly cleansed and disinfected, and the rats destroyed. After this, it became evident that the epidemic among rats was checked, as no other sick rats could be found. Examination of healthy rats showed them to be free of diplo-bacteria.

26,904. What disinfectants did you use?—Crude carbolic acid. I will give you the extract from my notes on the *post-mortem* :—

"*9th November*.—Three rats, No. 1, No. 2, No. 3, brought from 81, Burtolla Street. One died on the way to the laboratory, and was, therefore, not examined; another died in the laboratory, and a *post-mortem* was made at once. The axillary glands on the right side were enlarged, the liver was enlarged, and there was a greyish deposit on the surface. Specimen of spleen pulp showed diplo-bacteria in pure culture. The liver pulp showed diplo-bacteria, and the blood from heart showed diplo-bacteria. Cultures in bouillon next day showed diplo-bacteria in chains, and large cocciform bacteria single and in chains.

"*11th November*.—Rat No. 4, sent by Dr. Banks from Burtolla Street. The rat died a short time after arrival. *Post-mortem* held at once. The glands of both groins found to be enlarged. Liver congested with greyish white deposit on surface; spleen large and congested; the lungs and the auricles of heart congested; spleen and liver pulp showed diplo-bacteria varying in shape from the coccoid to the diplo-bacterial form.

"*16th November*.—Rat No. 5. Killed one of two rats brought yesterday from 81, Burtolla Street, the other having died during the night. *Post-mortem* showed no enlargement of glands. Intestines not inflamed. Liver not congested, but has a few whitish granular spots on the surface. Spleen congested, dark coloured, and enlarged. Heart normal. Specimen of heart blood, liver, spleen, show numerous diplo-bacteria, many of which were in chains.

"*19th November*.—Rat 6, sent by Mr. Scott, the inspector, from 81, Burtolla Street. Died at 2.40 p.m.

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Post-mortem at once. Has nearly the whole of its hair denuded. Has a large swelling on the neck about the size of a marble, another swelling of the same size under the left axilla; another swelling oblong in shape about three-quarters of an inch in length and half an inch in breadth on left groin. On deflecting the skin on abdomen and chest, the inguinal and axillary glands on right side slightly enlarged, those on left much swollen. The liver is enormously enlarged, occupying nearly half the abdominal cavity; the surface is spotted with white caseous matter; the pus from the glands teems with diplo-bacteria.

"20*th November*.—Cultures from glands show diplo-bacteria mixed with straight bacilli; cultures from heart blood show diplo-bacteria and coccoid bodies single and in chains, and a few long bacilli."

26,905. Were they inoculated into other animals?—No; I, unfortunately, missed doing so. I was extremely busy at the time, and was unable to carry on the investigation as I should have liked.

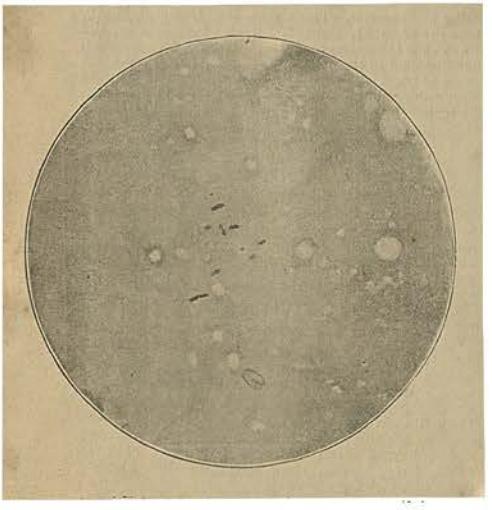
26,906. I understand that there were no cases among human beings associated with this rat-mortality?—No. One of the circumstances against the likelihood of cases occurring amongst the inhabitants was that in No. 14, Burtolla Street there were no inhabitants. We had turned them out previously. It was only a grain depôt, and in No. 81, Bartolla Street we turned the people out immediately from the lower floor, and the rest remained in the upper floor until we turned them out from there.

26,907. The only case of suspicious plague in that neighbourhood is the one you have described as number 7?—The only suspicious case was that of the child.

26,908. Will you proceed with the next case?—On the 3rd November, Bepin, an adult, working at a sugar factory, at No. 1 Raja Rajbullub Street, was reported to me by a native practitioner, Dr. Mukerji, as suffering from plague. Bepin had been attacked suddenly with fever, accompanied with severe head-ache pain, tenderness, and enlargement of the glands in the right groin. He soon became insensible, and died on the evening of 3rd November. Blood taken before death from vein in the arm, and from groin, showed diplo-bacteria, which were afterwards cultivated.

26,909. That is immediately before death?—Immediately before death. I have specimens of these cases. (*Handed to the President* (A, B, C)).

A.



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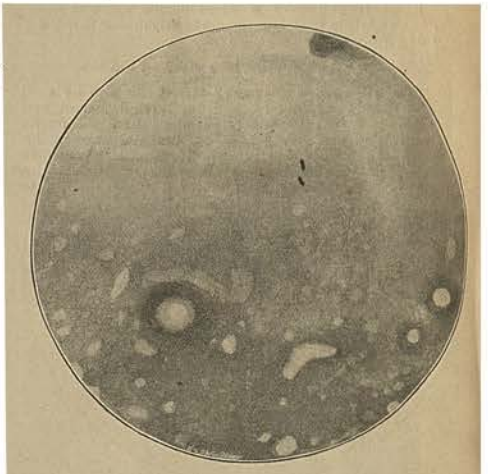

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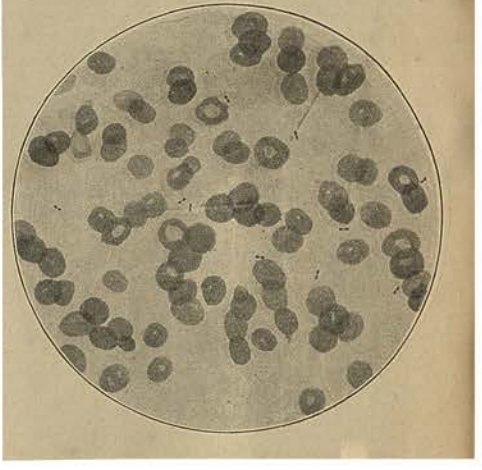
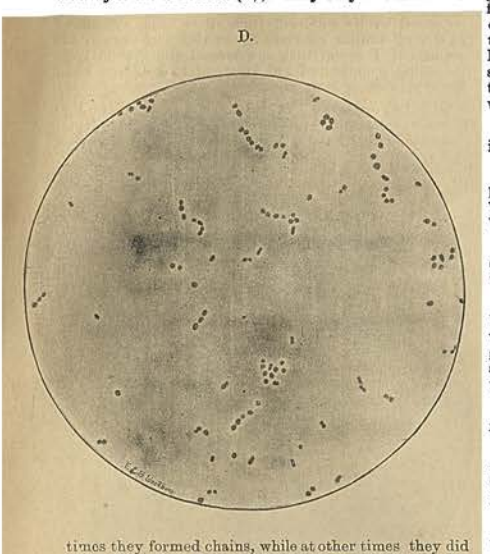


26,910. (*Prof. Wright.*) Are these drawings of cover glass specimens derived from that case?—No, not cover glass specimens in the case of the blood, but slide specimens.

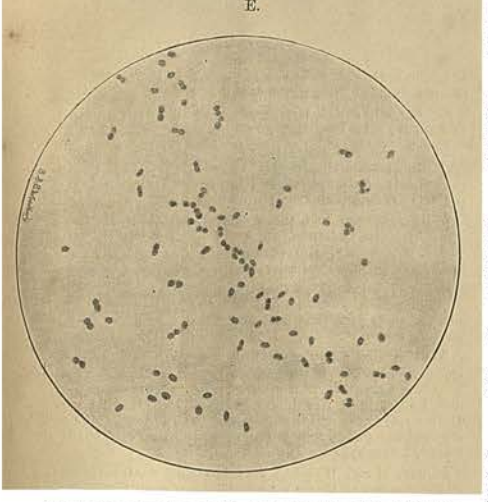
26,911. Did you draw off the blood with a syringe?—No, not with a syringe. I had one of the sterilised pipettes which are used in the laboratory.

26,912. (*The President.*) Are these all magnified to the same extent?—Yes, one-fifteenth (Reichert). This

is the appearance in the serum culture. (*Handing drawing to the President* (D)). They vary at times. At



times they formed chains, while at other times they did not. This (E) is from a rat which was killed by 1 c.c.



In another case 2 c.c. injected under the skin killed the rat.

26,913. (*Prof. Wright.*) Are these drawings of preparations which were made from rats killed with blood from Bepin?—Yes.

26,914. (*The President.*) Two c.c. is an enormous quantity, is it not?—Yes, it is; on the other hand 2 c.c. from the others already mentioned did not kill. My best specimens were, unfortunately, sent to Dr. Charles, and I did not get them back, so that I was not able to draw the specimens that were most characteristic.

26,915. Will you proceed with the next case?—On the 12th November I examined, along with Dr. Cobb, the dead body of a man named Marcellies, who lived in Bowbazar, and who was reported as having died of fever and glandular swelling. We found the axillary glands on one side much congested and swollen. I found organisms in that, but they were such that I could not give any opinion upon them. At one time they appeared to be of a similar kind, while actually later they came to be more like the streptococci of septicæmia. In December the Medical Board reported that none of the cases which had come before them were plague, but due to other causes.

26,916. (*Prof. Wright.*) All these cases were looked into by the Medical Board, I presume?—Yes.

26,917. (*The President.*) I want to make that perfectly clear. Each of these cases in human beings, which you have hitherto narrated came under the investigation of the Medical Board?—Yes.

26,918. Other cases investigated by the Medical Board did not come under your observation?—No, I do not think they were reported to me.

26,919. Will you state the next case?—In December 1896 a young girl, aged 16, living in a lane in Bowbazar, was treated for fever and glandular enlargements; the glands in both groins and in one of the axillæ enlarged, and after about a fortnight's illness suppurated. I saw the case with the medical attendant.

26,920. Did the case recover?—Yes, the case recovered, but it was tedious.

26,921. How near to each other were these two cases in Bowbazar; were the houses near to each other?—The two cases, Nos. 9 and 10, were not very far off from one another.

26,922. Have you any reason to suppose that there was any intercommunication?—No, I think not.

26,923. Did you ascertain that there could not have been?—No, but I may say that there had been a suspicious case of fever and glandular enlargement next door to No. 10. But I did not see the case, because the man had bolted by the time I visited the house.

26,924. Then will you give us the eleventh case?—About the same time two cases of fever, with glandular enlargement in one groin occurred in two boys, of one family, living in the southern suburbs of Calcutta. They were young boys about seven or eight years of age. The glands in the groin went on to suppuration.

26,925. Did you see the cases?—Yes.

26,926. What is the next case?—In January 1897 I saw a case of fever with glandular enlargement in the groin in a man who had arrived, a few days previously, from Singapore. He appears to have become unwell on the voyage; the disease corresponded in character with that in the Shropshire Regiment.

26,927. How long does it take to travel from Singapore to Calcutta?—A fortnight.

26,928. The man was already convalescent on arriving at Calcutta?—No, I do not think he was convalescent.

26,929. Did you see him?—Yes.

26,930. He had fever when you saw him?—Yes. The information I am about to give, I may say, is second hand. In January 1897 a large number of cases of fever with glandular swelling and buboes, some of which were fatal, occurred at Singapore.

26,931. What was your source of information? I understand it is the 21st Appendix to the First Volume of the Army Medical Reports, 1897?—That may be so, but I think I got it from the Singapore Reports. No satisfactory diagnosis appears to have been made. Active measures, however, for the segregation of the sick and the disinfection of the infected houses, were carried out. In connection with the occurrence of these suspicious cases it is to be noted that the Hong Kong authorities reported that undoubted cases of plague were brought to Hong Kong from Singapore. Some time in the early part of 1897, I was asked by the medical officer in charge of the Military Hospital at Alipore to see a native soldier who was ill with fever and glandular swelling of the parotid; also a boy in the same hospital, suffering from fever and a glandular

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swelling in groin. Both were well isolated, and every care was taken of them. The soldier died.

26,932. Will you proceed?—A medical man in practice in Calcutta informed me that he had, in the early part of 1897, come across several cases of fever with glandular swellings, all of which got well.

26,933. What was his name?—Dr. Coulter. He is one of the European medical men in private practice in Calcutta.

26,934. Will you proceed with Number 14?—In February, according to the report of Dr. M. J. Rosenau, the Quarantine Medical Officer to the Supervising Surgeon-General of the United States Marine Hospital Service, the British ship *Annie Maude* left Calcutta with three suspicious cases amongst the crew. The report is dated 16th July, and is as follows:—

"National Quarantine Station,
"Angel Island, California,
"July 16, 1897.

"SIR,

"I HAVE the honour to report the British ship *Annie Maude*, 143 days from Calcutta, was placed in quarantine to-day for disinfection. A short while after leaving Calcutta one of the crew was taken ill with swellings in the axilla, groin, and elbow, and died. Two more of the crew suffered with buboes, from which they recovered.

"Very respectfully,
"M. J. ROSENAU,
"Passed Assistant Surgeon,
"U.S., M.H.S."

26,935. Can you tell me with regard to all these cases whether you have had any evidence to suggest infectivity or contagiousness among them?—No, I have had none.

26,936. You have had no evidence to show that they emanated from any previous cases of plague or disease of a similar kind?—None.

26,937. You have had no evidence to show that any of the rats which died communicated the disease, or that the disease had been communicated to the rats from human cases?—None.

26,938. With regard to your blood examinations, did you make any similar examination, following, as nearly as possible, the same procedure, in cases altogether free from suspicion of plague?—Yes. Dr. Cobb and I examined a number of healthy men and took blood from them, following the same procedure, using the the same apparatus, and the results were entirely negative.

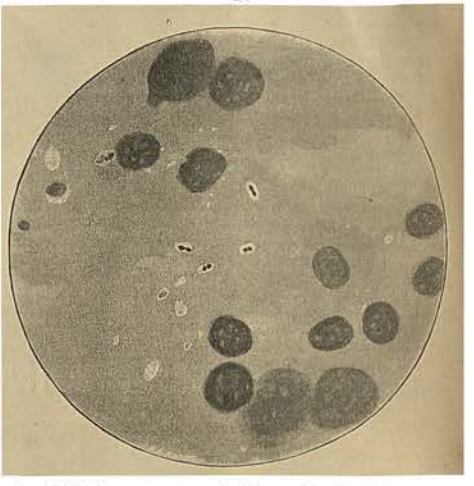
26,939. You found no organisms?—No organisms at all. I may mention that for years I have been examining blood in Calcutta. I am very much interested in vaccination, and also in the possible cultivation or discovery of an organism. During the process of trying several experiments, I have examined hundreds of cases of blood from children who have been vaccinated. I have also examined cases of patients who have had small-pox, and I have never seen any micro-organisms of this kind.

26,940. The procedure adopted in all these instances was the same as you have described?—Yes, very similar to that. It came to me as perfectly new to find that on the slide specimens there were organisms in these cases. It is supposed that the cultivations are all contaminations, but you cannot get an organism of that description which I have shown you in the slide specimens from the air.

26,941. What did you do to test that?—That is my opinion from a fair amount of experience. I have had slides specimens made in my laboratory over and over again, and had them exposed, and examined them afterwards, but have never found organisms. There is another point which I may, perhaps, mention to the Commission. I have been examining the blood of animals since 1894, with the object of seeing whether there were any organisms in the blood of those suffering from cattle plague. It was only in January 1897 that I found organisms in some cattle similar to those I have shown. There was an outbreak, very near the locality where the rats were dying. The cattle did not altogether suffer from the same symptoms which I had observed before in rinderpest. Some of the cattle evidently suffered from emphysema, with air passing into the tissues under the skin which made them look like stuffed animals. On examining two of these I found in the blood of these cattle, which were supposed to be suffering from rinderpest, organisms of a very similar character. On the *post-mortem* examination I found that the mesenteric glands were exceedingly congested and enlarged to a degree I had never previously seen.

26,942. You mean you found similar organisms to those in the rats—diplo-cocci?—Apparently diplo-bacteria (F). I have examined the blood of hundreds

F.



of cattle, both *post-mortem* and alive, and in the rinderpestic animals I have never found anything.

26,943. When did the cases occur in which you did find them?—In 1897.

26,944. At the same time?—A little later. They had the peculiarity which I have never found in rinderpestic animals, of the mesenteric glands being perfectly black, congested, and enormously enlarged.

26,945. Where had these cattle been kept?—They were kept in Calcutta, in some of the cattle-sheds which, I daresay, the Commission have seen, just a little north of the grain depôts.

26,946. You suggest that these cattle had also this disease, which you suppose to be plague—*pestis ambulans?*—I put that forward as a suggestion, but nothing more.

26,947. How many cattle did you see showing these symptoms?—There was an outbreak of the disease; I only examined, *post-mortem*, about three or four, and I examined the blood of only two in this way. Of course, these things only gradually dawn on one. I would not put it forward as more than an observation which, I think, is worthy of notice.

26,948. (*Prof. Wright.*) I understand you take each of these cases as being a probable case of plague. You have some grounds, in each case, for thinking it may have been a case of plague?—Yes, I looked at it in this light; seeing there was plague in Bombay, and that these cases had cropped up in Calcutta, it was being on the right side to take precautions and endeavour to isolate them. That was the position I took.

26,949. I quite see the practical necessity for doing so. In the case of Cotta, the boy had buboes in the groin, had he not?—Yes.

26,950. And we may assume from that, may we not, that these bubos were due to some absorption of bacteria, either from the genital tract or from some wound on the surface of the skin of the leg?—Yes.

26,951. And in this particular case there is a history of sexual contamination, is not there? There is a definite history on that point, is there not?—It was not definite.

26,952. I thought you reported the presence of a certain number of pimples on the *glans penis*?—Yes, but the glands had enlarged before that time.

26,953. I noticed that there was a disparity in that respect between your account and the account of the Medical Board. You think you have a history of the glands having enlarged first, *i.e.*, on the 8th September. Now the sexual intercourse is said to have taken place on the 13th, according to the Report of the Board?—Yes.

26,954. Further, if we take the history which you give, it appears that these glands got worse simultaneously with the appearance of "pimples" on the penis?—Yes.

26,955. Therefore, it is probable that some of the glandular trouble was due to the absorption of septic matter through the penis?—It might be that.

26,956. Therefore, if this was a suspicious case of plague, it was at any rate a case which was complicated by septic infection from the penis?—Yes.

26,957. And further, unless it is absolutely clear from the history that the glandular swelling appeared before the sores on the penis, it would be more natural to regard the case simply as a case of sexual bubo?—Yes; the only thing is this, that our examination alarmed people, and I think they naturally looked to something else.

26,958. As an explanation, you think they might have invented the venereal history to account for the presence of the bubo?—It is rather a hard thing to say that, but I think it is possible. Three medical men inquired into the case, and the first thing we naturally thought of was syphilis, and both Dr. Tomes and Dr. Cobb made very minute inquiries concerning this aspect of the case. We discussed the matter thoroughly, and having it in view that these glands were possibly due to syphilis, we were very particular in the history we got from the patient. There was no mention whatever at that time of this sexual connection on the 13th September.

26,959. In the history, which was obtained by the Medical Board which examined the cases, it was recorded that Cotta was treated twice for soft chancres by Mr. Mitchell, the Assistant Surgeon?—Yes, but they must have healed very rapidly, because I understand they were there only four days.

26,960. They are reported to have been better on the 4th, and you saw Cotta on the 9th. I do not know whether that account is correct?—He went on the 2nd and had an application, and they were better on the 4th. That is a very short time for them to get well.

26,961. But the principal point which induces you to believe that this was plague is the fact that you found bacteria in the cover-glass preparations of blood?—Yes, and the glands having enlarged before there was any venereal history.

26,962. Do you not think that general experience shows when you find bacteria in the blood in plague the case is a very serious one?—I know that is the general experience, but on the other hand, there is the experience of Kitasato. Kitasato found in 25 cases out of 28 the bacterium in the blood, and he states that it is found in cases of recovery. I have here a note from the "Twentieth Century," Vol. XV., which was written by Kitasato and another Japanese, Nakagawa. They described the two bacilli, and they say Yersin's bacillus is much larger than Kitasato's bacillus, and does not possess the distinctly diplo-coccus-like appearance of the latter. Owing to its polymorphism exact measurements are difficult to give. It does not possess a capsule. Yersin's bacillus is not mobile, and is decolorised by Gram's method. Cultural differences are equally conspicuous, on agar the growth of Yersin's bacillus is extremely luxuriant, and though the growth is rather slow at first, it continues for a week forming creamy white opaque colonies, projecting a good deal above the level of the surface of the media. Very young colonies are small and quite translucent. On the other hand, the colonies formed by Kitasato's bacillus are extremely delicate, transparent, small discs which attain the size of a pin's head and cease growing, and then disappear on the fourth day of incubation, presenting in all these respects a close resemblance to the growth of diplo-coccus pneumonia. Bouillon is not made uniformly turbid by the development of Yersin's bacillus; further, milk is not coagulated by the growth of Yersin's bacillus. The above-mentioned differential points ought to be enough to distinguish the one from the other. It is curious to observe that Yersin states that his plague bacilli (Y.B.) are found in the blood only of foudroyant cases, while Kitasato maintains that the bacilli (K.B.) can be found constantly in the blood; and further, that they may be found in the blood of convalescents for from three to four weeks after the symptoms have subsided.

26,963. At any rate it is the common opinion of bacteriologists that plague bacilli are only present in the blood in grave cases of plague, is that not so?—Yes, I admit that.

26,964. With regard to these other cases which occurred in the Shropshire Regiment, what opportunities do you think these men had for infecting themselves with plague? Did you bring the cases in any relation with the fact that these men had been in Hong Kong in 1895?—I only got my information second-hand.

26,965. And you learned, as a matter of fact, they arrived from Hong Kong on the 3rd January 1895?—Yes.

26,966. And these cases occurred in October 1890?—Yes, there were crops of them continually occurring from 1895 to 1896.

26,967. But in view of the fact that there was a continual crop of such cases recorded from the year 1892 onwards, and in view of the fact that non-venereal buboes are found all over India, do you think you can bring these cases into any relation with the fact that the regiment had served in Hong Kong?—Yes. I think Dr. Skinner's letter shows that these cases have not been continually occurring.

26,968. I have before me a record* of cases of inflammation of the lymph glands occurring in the troops in Calcutta from 1892 to 1896, and I find 29 cases recorded in the year 1892, 39 in 1893, 20 in 1894, and 42 in 1895?—I admit that, but I think possibly that these lymph cases may be similar to what occurred in England. There must have been some difference for the medical men to have taken notice of the cases that occurred in 1896 under Major Skinner, and the others.

26,969. You think these cases which occurred in 1896 were different?—I think so, otherwise why should they have been noticed at all? Why should the question arise? What are these cases? I have been looking into the Army Medical Report of 1894, and I notice that under the lymphatic and glandular system there were 11,000 admissions in England and 324 in Ireland, cases of a similar character. If these cases are so well known, how was it that it should attract the attention of the medical authorities at that time—in 1896—as being something peculiar, not knowing the cause; because first of all on the tickets of these cases they are marked "syphilitic," afterwards they are marked "malaria," and still later "unknown"? I think that very fact indicates that these cases which occurred in the Shropshire Regiment must be different from those which are commonly noticed elsewhere, and which were so common in the army under this particular classification.

26,970. We have had Major Skinner's evidence on that point, but we want to supplement his evidence by your evidence on the bacteriological facts. I understand you made cultivations from two of these cases, one, the case of the man Rabbid, and the other the case of Finney?—Yes.

26,971. You inoculated 12 tubes from each of these men?—Yes.

26,972. We have it from Major Skinner that all these tubes remained sterile except one; is that accurate or inaccurate?—It may have been so, but I could not say the exact number. I think there were one or two that gave this organism, but I would not be certain up on that.

26,973. Still, the large majority of the tubes you inoculated remained sterile?—Yes.

26,974. (*The President.*) There were 24 tubes in all and no growth appeared except, possibly, in two?—Two or three of each set, but the majority of them remained sterile.

26,975. (*Prof. Wright.*) How do you, in view of the fact that these drawings which you have put in, show 2, 2, and 5 bacteria respectively in each field, account

* *See* App. No. XXI. in Vol. I. of these Proceedings.

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for the fact that bacteria did not develop in each of the tubes you inoculated with this blood?—I mentioned that I took a large number of slide specimens, and it is only in one or two that I found this.

26,976. It was not in every field that you found bacteria, but only in a very few of the fields?—That is so.

26,977. Did you find bacteria in each cover glass?—No. By examination we found them in one or two specimens of each.

26,978. (*The President.*) Supposing you had one cover glass in which you found them, does that mean that they were found in only one field of the cover glass or several fields?—It was not a cover glass specimen, but a slide specimen.

26,979. One part only, or in many parts?—Not in many parts on one slide. I have had that drawn. That was the only one found on that particular slide.

26,980. (*Prof. Wright.*) Do not you think there it would be quite possible to find that number of contaminating micro-organisms on every slide?—I hardly think that it would repeat itself so frequently.

26,981. In view of the fact that diplo-cocci, such as you figure here, are very frequently met with in the earth in Calcutta, do you not that it is very probable these diplo-cocci which you figure may derive from contamination?—I hardly think so. Of course, if they had fallen on the ground it might be a different matter, but seeing they were put into a box and taken to the laboratory at once and examined, I do not think that could be so. I will not say it is an impossibility, though, personally, I do not think it is possible for a fully cultivated and regularly formed organism to alight from the air on to a slide. I do not wish in any way to press my views on the Commission. I want it to be understood that what is really wanted is truth. I have no bias one way or the other. Having met with these organisms, I am not attached to them.

26,982. In view of the fact that these cases occurred 18 months after the regiment came from Hong Kong and in view of the fact that so few bacteria were found in the blood I ask you whether it did not suggest itself to you that possibly these buboes had nothing whatever to do with the plague?—You must remember that although it was 18 months after the regiment came from Hong Kong there were continuous crops of cases recurring and that it was only the last ones which were ill which were examined.

26,983. Do you adhere to your opinion that these cases may have been cases of plague in view of the fact that these cases occurred not only in the Shropshire Regiment, but also in the Artillery, which has never been in Hong Kong?—I think the very fact that these cases occurred after the Hong Kong Regiment reached Calcutta shows that there is no reason why they should not also occur in the Artillery which were in close association with them.

26,984. That applies only if it can be shown that these cases among the Artillery did not occur also before the Shropshire Regiment arrived?—Yes. But what has struck me is this, that these lymph glands are so common in England and elsewhere that they must be well-known to Major Skinner and to others, and yet medical men came to the conclusion that very year that these cases might be venereal, might be malarial, or might be due to an unknown cause. They were cases that attracted attention and puzzled the medical men. It seems to me there was something different from what was usually met with.

26,985. I take it, in view of the evidence that we have already had from Major Skinner, that the facts did not present themselves to his mind in that light?—I think he says attention has been directed to it for certainly a year past.

26,986. Is there a single case among those which you have reported in which it appears to you to be absolutely established that you were dealing with a case of plague, or is your opinion that you were dealing with plague, based upon a general survey of all these cases? Are there any of these cases in which you obtained the plague bacillus in pure culture?—Yes, I think there can be little doubt that Giga, the child attended by Dr. Charles, was a case of plague; that Golab was a case of plague; and that Bepin was a case of plague; and I think, taking a general survey of the other cases, that most of them were probably mild cases of plague. I obtained the plague bacillus in a pure culture in the case of Bepin, and in 1897 I took the culture to M. Haffkine, when I was leaving India, and he examined the tube and said the growth was suspicious. He also examined the microbe microscopically and said it was very much like the plague bacillus. Then he subjected the bacillus to the stalactite test, but, unfortunately, it did not grow—apparently the culture was too old.

26,987. (*Mr. Cumine.*) Of the cases which you knew of, and thought to be plague in 1896, how many died?—I mentioned Bepin's case and then I mentioned that of Golab.

26,988. I mean what proportion died?—I have not worked out the proportion but they were exceedingly few. I did not go on the mortality.

26,989. If it had been really plague would not a large proportion have died?—Not necessarily. I have known instances where a large proportion have not died even in the Bombay Presidency. There was the outbreak which was reported by Dr. Dyson in Kosumba, in the Bulsar Táluka, where three-fourths of the cases were very mild. He reports that: "The disease was of "a mild type, characterised by slight fever of two or "three days' duration and the formation of buboes, "chiefly in the groin. Fully three-fourths of the 31 "cases which occurred were of this type, and during "one visit to the village I found two boys, about 12 "years of age, with buboes in the groin, whose fever "had been so slight as to escape observation, and "they had not been recognised as cases of plague."* You get different types of plague. Then there are well-known cases which were suspected to be plague in Astrachan† in 1877; there were 150 to 200 persons attacked without a single death. There was also the epidemic of plague at Resht‡ in which two forms of the disease were noticed, a severe and mild form. Of the former, who mostly died, there were about 170. There were about 600 mild cases which nearly all recovered.

26,990. Did any of those cases which you thought was plague produce any infection in the neighbourhood?—No, I was not able to trace any infection.

26,991. Or amongst the people who attended the sick?—No.

26,992. (*The President.*) Can you give us the reference to the statement made about Astrachan?—I think it is in the Medical Officer's Report for 1879, to the Local Government Board. I will send the exact reference to the Commission.†

26,993. (*Mr. Cumine.*) Did you attempt to see whether the bacillus, which you thought was plague bacillus, could be obtained from the blood of healthy animals, such as fowls?—No, I did not. I tried with rats. I examined 12 rats to see if they contained any bacilli.

26,994. Did you see the bacillus which Dr. Cunningham obtained from the blood of a healthy fowl?—No, I was not favoured with that.

26,995. You do not know whether that exactly resembles the one which you found?—No.

26,996. Were all the specimens of the supposed plague bacillus found by you exactly alike? Did they all resemble one another?—They seemed very much alike in character. Culturally, they did not go on alike. Sometimes they were of a more coccoid form—egg-shaped bacilli amongst them—and at other times they seemed to go into chains, and others were diplo-bacteria.

26,997. In the case of the lad Cotta, does not Dr. Dyson report that the local sores were noticed on the boy on the 17th, and that the swelling of the glands occurred on the 19th?—Yes, there is a discrepancy between the result of his inquiry, and the result of ours.

26,998. Were the symptoms of the boy Cotta such as one finds in plague? Dr. Dyson, for instance, says that his appetite was good, his tongue was clean after nearly a month's illness, that he never suffered from frontal headache, delirium, high fever, hæmorrhage, or epistaxis, or injection of the conjunctiva, that the enlarged glands have never caused severe pain, and, in

* *See* "Account of Plague Administration in Bombay Presidency; from September 1896 till May 1897," prepared by Mr. E. Couchman, I.C.S., page 244.

† *See* Report of the Medical Officer to the Local Government Board, for 1879, p. 49.

‡ *See* Tholozan, "Comptes Rendus," 1877, p. 432.

fact, that he has had none of the classical symptoms of plague. Do you admit that description of the symptoms as given by Dr. Dyson?—Hardly. I think there are varieties.

26,999. Are these symptoms of the boy Cotta correctly described?—Yes.

27,000. Are these symptoms compatible with his having had plague?—Oh, yes, I think so. For that reason I would mention what is stated by Dr. James in his report on the Hong Kong epidemic, which appears in the Army Medical Department Report for 1893. In Appendix No. 5, he states, on page 331, that the disease is endemic in the province of Yunan, and cases occur every year, those attacked having buboes, but very little constitutional disturbance, and all recovering. On page 335, he mentions that some of the soldiers employed in the working parties became affected, and some who were not so employed, and an officer, Captain Vesey, of the Shropshire Regiment, was taken ill early in June of plague and succumbed. On p. 348 he states that in abortive plague the bubo occurs without fever. Similar cases to those in Yunan occurred in Mesopotamia. I think it was Dr. Tholozan, in his work on plague, who mentions that from epidemic to epidemic the bridge is filled up by these mild cases of plague, which produce very little constitutional disturbance. Dr. Dickson, at page 55 of the Report of the Medical Officer for 1879 to the Local Government Board, describes the prevalence of *glandular swellings free from fever* two or three months previous to fatal plague in Hillah and Bagdad, and on the cessation of plague *apyretic glandular swellings* reappeared again for two months longer.

27,001. Can you give us the authorities for the statement about Yunan?—Major James mentions it in his report on Hong Kong.

27,002. Do you know who was his original authority?—No. Possibly Dr. Tholozan's work would give some of these mild cases of plague.

27,003. (*The President.*) Do you know the title of that?—May I be allowed to send the reference to you. (Note by witness on correcting proof of his evidence: "La Peste en Turquie dans les temps modernes, sa prophylaxie defectueuse, sa limitation spontanée.")

27,004. (*Mr. Cumine.*) In the case of the boy Tincauri Pal, was there any history that before his becoming ill on this occasion he had now and then suffered from fever and cold and swelling of the inguinal glands?—I did not discover a history of that kind.

27,005. With regard to these climatic buboes, that is to say, buboes such as were seen in the Shropshire Regiment, have they been noticed to any large extent and for a long time on the East Indian station, and to a lesser extent on the Mediterranean and China station?—Yes. It is stated that cases like that have been reported. I remember that Surgeon Godding, of the *Centurion*, wrote a paper* in the *British Medical Journal* on climatic buboes, and gives instances. The peculiarity of his instances was the fact that they were seamen who were stationed at Hong Kong at the time of the plague.

27,006. He says: "I have myself seen the worst "cases on the East Indian station at Zanzibar and "adjacent coasts, the patients having huge masses of "glands in the groin often suppurating, producing "anæmia and debility"?—That is among the seamen at Zanzibar. Many of the ships that go to Zanzibar, go also up the Persian Gulf, and have communication with those places where, I believe, these buboes occur frequently. I was speaking to a medical man who had been in Bagdad for a number of years, and he stated that every year there were a few cases of glandular swellings.

27,007. (*The President.*) They were supposed to be cases of mitigated plague?—Yes, so that I do not think much importance can be attached to these cases being affected at Zanzibar, considering that those affected most likely visited the region where cases occur.

27,008. (*Mr. Cumine.*) Does he not say they occurred also, though less frequently, in the Mediterranean, Australia, and the West Coast of Africa?—I think it is very likely that they would occur, though possibly not the same disease as the glandular swelling in plague infected areas. The difficulty is to differentiate the one from the other, unless special attention is given to each, and the several likely causes investigated.

27,009. (*The President.*) I gather that your chief reason for believing these cases to be a form of plague was the microscopical examination?—Partly microscopical and partly for other reasons. In Giga and Bepin, the symptoms are, to my mind, after my experience in Bombay and Poona, typical plague, such as may be seen anywhere in a large epidemic, and, similarly, though more obscure, are some of the others. The death of the rat with swollen glands in the house of Giga and similar micro-organisms being found in the child and rat strengthened this opinion, also the rats dying to such an extent in the grain depôts, and having very similar micro-organisms in their organs.

27,010. Your cases do not illustrate any power of infection at all?—I have not noted any.

27,011. You have made inquiries in that direction?—Yes.

27,012. You did not find it in any case?—No; they seemed to be dotted about. A similar discussion took place, I believe, with reference to the appearance of an illness with glandular enlargements when the Pali plague broke out in 1836. Doctor Forbes, who investigated the cases, came to the conclusion that they were a mild form of plague. It was stated at the time that cases of a similar nature were common and due to malaria, but his investigation indicated that the illness appeared some time before plague broke out, and the cases were connected with plague and not malaria. He made very particular inquiries of native medical men as to the prevalence of buboes after malarial fever, and they did not know of cases at that time; subsequently they met with them.

27,013. In regard to the cases in which cattle appeared to have suffered from something like plague, are you aware that in India, generally, cattle often live in the same houses as human beings?—Yes, that is so.

27,014. In many instances these houses contain plague-affected human beings?—Yes, in the hills.

27,015. Not only in the hills, but, in the villages in the plains?—Yes.

27,016. Do you know if anything similar to plague has occurred among these cattle in India in any city outside of Calcutta?—No, I have not read of any. I have watched the cases with that view, but nothing has come to my notice. Dr. Weir records that there was a great mortality among cattle in Bombay in the middle of 1896.

27,017. Very virulent forms of plague have occurred in human beings in houses in which cattle have been kept?—Yes.

27,018. There appears to be no evidence that these cattle have ever taken the plague?—None has been collected.

* *See* App. No. XXI. in Vol. I. of these Proceedings.

(Witness withdrew.)

(Adjourned till Saturday, 20th May.)

At The India Office, Whitehall.

SEVENTY-SECOND DAY.

Saturday, 20th May, 1899.

PRESENT:

PROF. T. R. FRASER, M.D. LL.D., F.R.S. (*President.*)

MR. J. P. HEWETT, C.I.E.
PROFESSOR A. M. WRIGHT, M.D.

MR. A. CUMINE.

Mr. C. J. HALLIFAX (*Secretary*).

Captain H. D. MASON, R.A.M.C., called and examined.

Capt. H. D. Mason, R.A.M.C.

20 May 1899.

27,019. (*The President.*) What are your medical qualifications?—I am M.R.C.S.

27,020. What was the appointment which you held in India?—I was on plague duty under the Government of India, in the Cutch State.

27,021. You were in the Cutch State during the time of the plague epidemic?—Yes.

27,022. And you had an opportunity of seeing many cases treated by ordinary methods?—Yes.

27,023. And many also treated with serum?—Yes.

27,024. I think of each group you have tabulated 100 cases?—The cases given in my précis were one typical hundred of each—one hundred taken out of many. Each group of cases was taken under exactly the same conditions, 100 being treated by ordinary methods, and 100 with the serum antipesteux. Both series were taken between the first and the fourth day, and the two have been contrasted with each other.

27,025. These cases were not selected for any special reason?—Not the least in the world, they were treated exactly as they were admitted.

27,026. And the gravity of the illness?—Had nothing whatever to do with it. In some cases we did make a distinction at first. Those who died in the first 24 hours were eliminated. In these lists we thought that the cases which died in the first 24 hours should be included, and that has been done.

27,027. You have included them all in your tables?—Yes.

27,028. Will you put the tables in?—Yes, they are as follows:—

ONE HUNDRED CASES of PLAGUE TREATED by ORDINARY METHODS in the BRAHMAPURI HOSPITAL, CUTCH MANDVI.

Cases admitted between first and fourth days (four after or unknown).

No.	Name.	Sex.	Age.	How long Ill.	Admitted to Hospital.	Buboes.	Result.
					1897.		
1	Mohanji	Male	30	2 days	25th May	Nil	Died.
2	Lalji	"	27	Very old case	"	"	"
3	Cooverji	"	35	4 days	"	Left groin	"
4	Khimji	"	50	2 "	"	Right groin	"
5	Shambai	Female	18	2 "	"	Nil	"
6	Panabai	"	18	Not known	"	"	"
7	Vishnubai	"	50	3 days	"	"	"
8	Moonjibai	"	30	Nil	"	"	"
9	Premjibai	"	18	"	"	"	"
10	Ratanshi	Male	20	2 days	"	"	"
11	Soonderbai	Female	70	2 "	"	"	"
12	Dhanbai	"	32	2 "	"	Left axilla	"
13	Nanbai	"	30	3 "	26th May	" groin	"
14	Dharamshi	Male	70	3 "	"	Nil	"
15	Sambai	Female	35	4 "	"	"	"
16	Dahya	Male	25	3 "	"	"	"
17	Harjiwan	"	55	3 "	"	"	"
18	Pritambai	Female	60	3 "	"	"	"
19	Kashibai	"	23	2 "	"	"	"
20	Gangabai	"	40	3 "	"	Left groin	Discharged.
21	Joshi Manji	Male	50	2 "	"	" axilla	Died.
22	Gombai	Female	10	2 "	"	" "	"
23	Poonja	Male	85	3 "	"	" parotid	Discharged.
24	Sungsi	"	20	2 "	"	-	Died.
25	Velji	"	80	4 "	"	Left axilla	"
26	Lakanbai	Female	32	3 "	"	Right axilla	"
27	Buddibai	"	20	2 "	"	-	"
28	Lalji	Male	19	3 "	"	Right inguinal	Discharged.
29	Govan Khimji	"	60	2 "	"	-	"
30	Meghji Premji	"	30	2 "	27th May	Left groin, small	Died.
31	Premabai	Female	22	4 "	"	Right axilla	"
32	Lohsajbai	"	16	3 "	"	" groin	"
33	Velbai Rambai	"	13	2 "	"	Nil	"
34	Vhalibai	"	14	2 "	"	Right axilla	Discharged.
35	Mithoobai	"	30	2 "	"	" parotid	Died
36	Pragji	Male	10	2 "	"	Nil	"
					"	Right groin	"

No.	Name.	Sex.	Age.	How long Ill.	Admitted to Hospital.	Buboes.	Result.
					1897.		
37	Mooli	Female	15	4 days	27th May	Right groin	Discharged.
38	Meethi	„	20	4 „	„	„ axilla	Died.
39	Painbai	„	50	2 „	„	Left parotid	„
40	Velibai	„	38	1 day	„	Right groin	Discharged.
41	Gomtibai	„	40	2 days	28th May	„ „	Died.
42	Vasanji	Male	80	2 „	„	„ axilla	„
43	Manekbai	Female	25	2 „	„	„ groin	„
44	Ramanbai	„	30	2 „	„	„ „	„
45	Hirobai	„	6	2 „	„	„ „	„
46	Nanji	Male	6	2 „	„	„ „	„
47	Dharsi	„	14	6 „	„	Pneumonia	„
48	Manbai	Female	4	2 „	„	Right groin	„
49	Veljì	Male	10	3 „	„	-	„
50	Panoo	„	25	4 „	„	-	„
51	Jetha	„	35	2 „	„	-	„
52	Virbai	Female	16	1 day	„	Left groin	„
53	Gomatibai	„	50	1 „	„	Nil	„
54	Damodar	Male	11	4 days	„	Right axilla	„
55	Loolibai	„	35	1 day	„	„ groin	Discharged.
56	Naran	„	45	2 days	„	Nil	Died.
57	Nathibai	Female	30	2 „	„	Right axilla	„
58	Charupanbai	„	25	4 „	„	„ inguinal	Discharged.
59	Khimji	Male	60	4 „	„	„ groin	Died.
60	Hansibai	Female	18	6 „	„	-	„
61	Kalianji	Male	21	3 „	„	Left groin	„
62	Panchibai	Female	12	1 day	„	„ „	„
63	Gangabai	„	25	2 days	„	Right groin	Discharged.
64	Kanji	Male	10	1 day	29th May	„ axilla	Died.
65	Pralimanbai	Female	5	4 days	„	„ groin	„
66	Ramdass	Male	35	1 day	„	Maxillary	„
67	Parvatibai	Female	30	1 „	„	Left groin	„
68	Kanji	Male	13	1 „	„	Right „	„
69	Wandubai	Female	20	2 days	„	Left „	„
70	Manekbai	„	8	4 „	„	Right „	„
71	Champsi	Male	22	3 „	„	„ „	„
72	Devkorebai	Female	15	2 „	„	Left „	„
73	Dhyanbai	„	28	3 „	„	-	„
74	Virji	Male	9	3 „	„	Right cervical	„
75	Manjibai	Female	20	1 day	„	Left groin	„
76	Kalidas	Male	35	2 days	30th May	-	„
77	Amratbai	Female	50	4 „	„	Right and left groins	Discharged.
78	Gangabai	„	—	1 day	„	Nil	Died.
79	Ratanbai	„	42	2 days	„	-	„
80	Nursey Jiva	Male	9	4 „	„	Left groin, left axilla, œdema of left foot and hand.	Discharged.
81	Cooverbai	Female	20	1 day	„	Left groin	Died.
82	Motibai	„	7	4 days	„	Tenderness, left groin	„
83	Ladibai	„	40	2 „	„	Left groin	Discharged.
84	Manekbai	„	48	3 „	„	„ axilla	Died.
85	Ramji	Male	41	2 „	„	„ groin	Discharged.
86	Govindji	„	40	1 day	„	„ „	Died.
87	Samji	„	40	2 days	31st May	„ „	„
88	Moolibai	Female	50	2 „	„	Nil	„
89	Hansraj	Male	25	1 day	„	Left groin	„
90	Lakhmibai	Female	14	2 days	„	„ axilla	„
91	Motio	Male	6	2 „	„	„ cervical	Discharged.
92	Ramji	„	8	1 day	„	„ inguinal	„
93	Sivji	„	18	1 „	„	„ „	Died.
94	Motibai	Female	35	3 days	„	„ groin	„
95	Lilbai	„	20	1 day	„	Right „	„
96	Panbai	„	40	3 days	1st June	-	„
97	Kara	Male	20	3 „	„	-	„
98	Kanubai	Female	70	2 „	„	Right cervical	Discharged.
99	Hirabai	„	25	3 „	„	„ „	Died.
100	Hadhubai	„	35	2 „	2nd June	„ groin	„

In cases treated by ordinary methods the prognosis is better in children than men and in men than women.

Of 260 deaths in the Brahmapuri Hospital (Hindus) there were :—

Children under 10	25
Males	89
Females	146
Total	260

Whilst in 3,516 deaths from all hospitals, there were :—

Children	563
Males	1,226
Females	1,727
Total	3,516

The healthy and robust appear not only prone to contract the disease, but to suffer from the most virulent forms, and die in as great a proportion as those of weaklier frame and less sthenic constitution.

The epidemic at Mandvi was at its height in May and June. The non-inoculated cases were collected in May and June. The inoculated cases treated in the Mandvi Brahmapuri Hospital in May and June are comparable.

The epidemic at Gundiali town was at its height in August and September. The inoculated cases treated there during that time are comparable to the non-inoculated cases treated in the Brahmapuri Hospital in Mandvi when the epidemic was at its height there. The same applies to Merau village.

The cases treated in the various hospitals are bracketed.

Capt. H. D. Mason, R.A.M.C.

20 May 1899.

CASES of PLAGUE treated with SERUM ANTIPESTEUX in CUTCH MANDVI.

No.	Name.	Sex.	Age.	Admitted to Hospital.	How long ill when injected.	Total Quantity Injected.	Result.	Buho.	Remarks.
				1897.			1897.		
1	Nursey Jiva	M.	9	30.5	4 days	90 c.c.	Discharged	Parotid, left groin, left cervical.	
2	Jayanak	,,	35	,,	,,	105 ,,	Died 4.6	Right axilla.	Not injected till 4th May.
3	Ramnubai	F.	15	1.6	1 day	120 ,,	,, 3.6	,, ,,	
4	Sivjee	M.	8	,,	2 days	210 ,,	,, 11.6	Right inguinal and femoral.	
5	Godavribai	F.	32	2.6	,,	220 ,,	Discharged, 11.6	Right groin, plagic pustule left foot.	
6	Bhababai	,,	13	,,	4 ,,	190 ,,	Died 6.6	Left femoral, right and left feet, swollen right and left cervical.	
7	Hirjee	M.	8	,,	1 day	50 ,,	,, 4.6	Left axilla.	
8	Matoobai	F.	40	3.6	2 days	140 ,,	,, 5.6	Left femoral.	
9	Rattanbai	,,	45	4.6	,,	170 ,,	,, 11.6	Right groin.	
10	Rattanbai	,,	29	,,	,,	200 ,,	,, 23.6	Left femoral (pneumonia).	
11	Godavribai	,,	30	,,	1 day	160 ,,	Discharged, 11.6	Left groin.	
12	Kankoobai	,,	20	,,	,,	100 ,,	,,	Nil.	
13	Mambai	,,	40	,,	,,	140 ,,	Died 9.6	Left femoral.	
14	Karoo	M.	40	,,	2 days	230 ,,	,, 8.6	Nil.	
15	Dhaneshwar	,,	45	5.6	,,	170 ,,	,, 9.6	Right inguinal, suppression of urine.	
16	Sambai	F.	28	6.6	,,	230 ,,	,, 13.6	Right groin (pneumonia).	
17	Janki	,,	25	7.6	3 ,,	140 ,,	,, 11.6	Left groin.	
18	Bambabai	,,	60	9.6	,,	120 ,,	,, 12.6	Right axilla.	
19	Sumar (Khoja Hospital).	M.	60	,,	4 ,,	100 ,,	Discharged, 19·6	Left groin.	
20	Rattanbai	F.	21	11.6	3 ,,	40 ,,	,,	Right groin.	
21	Rasambai	,,	30	15.6	,,	90 ,,	,,	—	
22	Padmabai	,,	10	,,	,,	100 ,,	,,	—	
23	Jane Pereira	,,	33	,,	1 day	150 ,,	Died	—	
24	Koomabai	,,	45	22.6	2 days	120 ,,	,,	Left submaxillary.	
25	Aboo	M.	55	23.6	1 day	150 ,,	,,	Right groin.	
26	Samji	,,	50	,,	1 ,,	90 ,,	Discharged	Left axilla.	
27	Hazarabai	F.	18	19.6	2 days	110 ,,	,,	Left groin.	
28	Havabai	,,	17	,,	,,	10 ,,	,,	,, ,,	Severe central intoxication. Bilious vomiting, sputa typical.
29	Monji Jiva	M.	20	3.7	,,	80 ,,	Died	,, ,,	
30	Devkanbai	F.	18	5.7	,,	75 ,,	,,	Right axilla.	
31	Manekbai	,,	12	,,	,,	100 ,,	,,	Tenderness both groins.	
32	Setambai	,,	105	14.7	4 days	70 ,,	,,	Left groin.	
33	Sackerbai	F.	7	4.8	1 day	45 ,,	Discharged, 6.8	Nil	Swelling and tenderness in right groin.
34	Bachibai	,,	10	,,	,,	50 ,,	,, 6.8	,,	
35	Daibai	,,	40	6.8	,,	100 ,,	Died 8.8	,,	
36	Ghelo Ajramal	M.	11	,,	,,	30 ,,	,, 7.8	,,	Passed round worms.
37	Kalimanbai	F.	11	,,	,,	120 ,,	,, 9.8	Left inguinal.	
38	Rhamabai	,,	25	4.8	4 days	95 ,,	Discharged, 13.8	Right axilla.	
39	Manubia	,,	7	10.8	3 ,,	70 ,,	,, 13.8	Left inguinal.	
40	Monji Kersondas	M.	14	16.8	1 day	80 ,,	Died 18.8	Nil.	
41	Mena Tello	F.	11	,,	,,	100 ,,	,, 13.8	Left and right groin, right axilla.	
42	Koorbai Vello	,,	9	,,	,,	30 ,,	,, 16.8	Right groin.	
43	Menbai Feloo	,,	—	17.8	2 days	110 ,,	,, 18.8	Nil	Pemphigoid rash on face and back.
44	Velji Ladha	M.	30	19.8	,,	130 ,,	,, 22.8	Left inguinal.	
45	Dayal Chamsay	,,	50	,,	3 days	180 ,,	,, 24.8	Right groin.	
46	Harbai Vello	F.	—	17.8	2 ,,	80 ,,	,, 20.8	,, ,,	
47	Dosa Vishram	M.	28	20.8	,,	130 ,,	,, 24.8	Left inguinal.	
48	Derkanbai Dhauso.	F.	9	17.8	3 days	100 ,,	,, 22.8	Right axilla, right cervical, left cervical, left axilla, right and left inguinal.	
49	Nursee Osmal	M.	—	18.8	2 ,,	140 ,,	,, 21.8	Right groin.	
50	Premji	,,	14	13.8	1 day	120 ,,	Discharged, 30.8	Right axilla.	
51	Lakhmibai	F.	10	15.8	—	100 ,,	,, 2.9	Left groin.	
52	Raoji Jivan	M.	11	10.8	—	100 ,,	,, 30.8	Right and left groin.	
53	Soonderji	,,	—	15.8	—	130 ,,	Died 19.8	Left axilla and right groin.	
54	Gangabai	F.	22	16.8	4 days	160 ,,	,, 28.8	Nil	Muscular rheumatism, secondary pneumonia.

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	No.	Name.	Sex.	Age.	Admitted to Hospital.	How long ill when injected.	Total Quantity injected.	Result.	Bubo.	Remarks.
					1897.			1897.		
Guidiala.	55	Nagai Bharu	F.	10	17.8	2 days	130 c.c.	Discharged, 2.9	Right axilla, right inguinal.	Secondary, right leg. and synovicle.
	56	Kanji Devji	M.	7	19.8	3 „	100 „	„ 2.9	Left groin and left cervical.	Secondary.
	57	Bhanji Jiva	„	12	20.8	2 „	100 „	Died 25.8	Left inguinal.	
	58	Hila Mona	„	9	23.8	1 day	120 „	Discharged, 2.9	Left cervical and tenderness, both groins.	
	59	Jethibai Baoji	F.	9	24.8	3 days	100 „	„ 1.9	Right inguinal	Absorbed.
	60	Kanji Monji	M.	4	26·8	2 „	40 „	„ 2.9	Nil.	
	61	Korsibai	F.	13	„	„	100 „	„ 2.9	Left axilla.	
	62	Monbai	„	40	„	„	120 „	„ 2.9	Right inguinal.	
	63	Velo Versi	M.	7	28.8	„	50 „	„ 2.9	Right femoral.	
	64	Vejabai Serang	F.	40	„	„	130 „	Died 31.8	Right inguinal.	
	65	Doongarsi	M.	12	28.8	2 days	45 „	„ 30.8	Left groin.	
	66	Noorbai Jakoo	F.	—	17.8	—	120 „	Discharged 27.8	„ „	
	67	Lakhabai	„	—	—	1 day	130 „	„ 28.8	Right groin.	
	68	Valji Monsee	M.	12	18.8	2 days	100 „	„ 5.9	Left axilla.	
	69	Kamilia Baunu-hall.	F.	—	25.8	1 day	160 „	Died 29.8	Nil.	
	70	Mensee Lakha	M.	—	28.8	3 days	160 „	„ 29.8	„	
	71	Menbai Koorarji	F.	20	27.8	2 „	120 „	„ 29.8	Tenderness, right groin.	
	72	Ladoo Passor	„	12	28.8	2 „	30 „	„ 30.8	Right axilla, with effusion.	
	73	Villa Khoda	M.	35	„	2 „	160 „	„ 2.9	Nil.	
	74	Khetbai Napoo	F.	45	„	2 „	160 „	„ 6.9	Left groin, L.	Popliteal bubo, acute thrombosis of left femoral and popliteal and posterior of tibial.
	75	Devrajookede	M.	40	2.9	2 days	150 „	„ 6.9	Left groin.	
	76	Rhanabai	F.	10	6.9	5 „	150 „	„ 6.9	Primary plague pneumonia.	
	77	Monabai Lalji	„	24	2.9	4 „	120 „	Discharged, 14.9	Effusion, right axilla.	
	78	Demotbai	„	—	„	2 „	180 „	„ 13.9	Nil.	
	79	Mamibai	„	8	„	3 „	60 „	„ 14.9	Left inguinal.	
	80	Premabai Jerat	„	60	5.9	2 „	160 „	„ 10.9	Nil.	
	81	Rhanbai Amod	„	40	„	3 „	150 „	„ 15.9	Left groin.	
	82	Haji Hoosain	M.	50	„	2 „	220 „	Died 10.9	Right axilla.	
	83	Sonabia Joose	F.	25	„	3 „	150 „	„ 8.9	Nil	Primary plague pneumonia.
	84	Poonjibai Jeraij	„	18	6.9	1 day	130 „	„ 8.9	Left Inguinal.	
	85	Virbai Dongarsi	„	14	7.9	1 „	60 „	„ 11.9	Right groin	Left sub-maxillary and popliteal bubo developed 9.9.97.
	86	Ratibai Dersi	„	10	8.9	2 days	45 „	Discharged, 17.9	Sub-clavicular	Bubo, left side, developed.
	87	Phaphoobai Joones.	„	19	„	3 „	90 „	Died 9.9	Left groin.	Eyes injected.
	88	Panchabai Jirat	„	30	„	2 „	110 „	„ 13.9	Left axilla.	
	89	Ajbai Raghaiji	„	40	2.9	3 „	120 „	„ 8.9	Left inguinal	Primary plague pneumonia.
Gundiali. Merau.	90	Sagiban	„	—	5.9	1 day	90 „	Discharged, 18.9	Left groin.	
	91	Manbai Harau-gar.	„	35	„	2 days	140 „	„ 9.9	Right inguinal.	
	92	Manabai Ragoji	„	9	6.9	2 „	60 „	Died 9.9	Right axilla	With effusion.
	93	Logakhelley	M.	75	„	2 „	160 „	„ 8.9	Nil.	
Merau.	94	Bhanji	„	25	„	2 „	150 „	„ 9.9	„	
	95	Malibai	F.	50	7.9	2 „	120 „	„ 9.9	Right groin.	
	96	Pababai	„	24	8.9	1 day	170 „	„ 12.9	Glands parotid, left.	
	97	Mansi	M.	30	11.9	3 days	80 „	Discharged, 20.9	Left groin.	
Gundiali.	98	Monji Morarji	„	12	4.9	2 „	100 „	„ 23.9	Right cervical, right inguinal.	Right and left groins developed, 9.9.97.
	99	Gangbeir	F.	16	5·9	2 „	150 „	„ 23.9	Right inguinal.	
	100	Meghaibai Hunsary.	„	25	10.9	2 „	120 „	„ 21.9	Right Abdominal.	

27,029. Will you briefly state the results?—In contrasting the cases treated by serum and those treated by ordinary methods it will be seen that out of 100 cases of the former 59 died and 41 recovered; of the latter 83 died and 17 recovered.

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27,030. What is your opinion as to the value of the serum antipesteux which you used?—I think it is of the greatest value in all except the very gravest cases. On those, apparently, it had very little effect—those who same with the most marked symptoms of plague, marked delirium, high temperature, continuous vomiting, &c. On those, as I say, it seemed to have little or no effect, but in the milder cases, undoubtedly, it produced a favourable effect.

27,031. As contrasted with the ordinary treatment?—Yes, I do not think the ordinary methods had any effect at all—not the slightest effect in the world.

27,032. Your percentage of recoveries is considerably better with serum than without it?—Yes.

27,033. What serum did you employ?—The serum prepared by Dr. Roux, of the Pasteur Institute.

27,034. Could you state generally what were the doses that you used?—They varied. Of course, with us it was quite an experiment. It had never been used before, except a little in Bombay, and when it came to us we used it in small doses at first—10 c.c. and 20 c.c.—but afterwards in very much larger doses, up to 60 c.c.

27,035. Are you able to contrast the effects of the smaller doses with those of the larger doses?—It is quite possible that I could, but I cannot from these tables. I had every case which I treated entered in books, but without going through these books I do not think I can contrast the effect of the smaller doses with the larger. But, roughly, I should say that the larger doses were more successful than the smaller ones, because it was that fact which led us to use the larger doses.

27,036. The smaller dose was not so satisfactory as the larger one?—No.

27,037. Perhaps, as you have the data, you could put them into some statistical form for us?—I will endeavour to do so when I go back.

27,038. We want you to contrast as nearly as you can the larger with the smaller doses?—The following figures give the required comparison:—

	Cases.	Deaths.	Recoveries.
Small doses (60 c.c. and under) -	14	7	7
Large doses (over 60 c.c.) - -	86	52	34

In the recrudescence I have a certain number of cases which were treated by very large doses in certain caste hospitals, and those were very curious. Amongst the Muhammadans 9 out of 18 recovered, but among the Bhatias we only injected the serum in six cases, and every one of them died.

27,039. Were the latter treated by larger doses?—Yes.

27,040. The result was not altogether satisfactory even with the larger doses?—It was among the Muhammadan caste, but not amongst the Bhatias.

27,041. Have you any explanation of that?—Nothing more than the general explanation, that the Hindus are a much feebler class of men; they are vegetable eaters. The Muhammadans have much greater vitality and finer physique altogether. Whether that is any explanation or not I am not prepared to say.

27,042. On the whole, the doses with which you treated these several groups were much the same?—Yes. You will see in the following table, of the 18 Muhammadans inoculated 9 recovered, and that every one of the Bhatias died. The following is the table I refer to:—

CASES inoculated with SERUM ANTIPESTEUX at CASTE HOSPITALS during RECRUDESCENCE of 1898.

Name of Hospital.	Admissions.	Inoculated.	Discharged.	Died.
General - - -	—	35	10	25
Banniah - - -	—	1	0	1
Bhatia - - -	—	6	0	6
Muhammadan - -	—	18	9	9

I remember distinctly that all these cases were very serious indeed, and which would certainly not have got well with any ordinary treatment.

27,043. Do you mean in the four groups?—No, in the Bhatia group.

27,044. Then it would be a mere question of individual resistance to the severity of the illness?—Perhaps so. The reason I remembered these cases was that we had great difficulty in getting the Bhatias to be inoculated. We were very confident of the result after inoculating the Mahemmedans, and we did what we could to get the Bhatias inoculated. But, unfortunately, every one of them died, and, therefore, we did not think it wise to go on after that on account of the feeling it produced in the caste.

27,045. At what stage in the illness did you commence the treatment?—As soon as ever we could get them. The earlier the inoculations the better the results.

27,046. You commenced between the first and the fourth day?—Yes, after the fourth day it was hopeless. The patient either got well in that time or it was hopeless.

27,047. How many doses did you inject in each case?—They also varied according to the results of the temperature charts. The temperature charts were all taken, and with a big fall the indication was not to continue the treatment, but directly the temperature began to rise we gave another large dose. As soon as the temperature went up we gave three or four inoculations.

27,048. Taking the cases generally, how many injections did you make?—That I cannot tell you without the temperature charts. I much regret that I did not bring them with me.

27,049. Perhaps you will send them?—Yes.* You will see that on each fall of the temperature the amount of the injection is given above the fall, that is to say, if the temperature went up to 104°, on the top of the 104° the amount of the inoculation would be registered, and if it came down again—wherever it was given on the temperature chart—the amount was registered on it.

27,050. What was the most conspicuous beneficial effect which you observed?—The fall in the temperature in the first place, and the general condition altogether. For instance, the patient who came in delirious became calmer, the temperature fell, the vomiting stopped, and there was general amelioration of the condition.

27,051. Were those good results obtained in cases which afterwards died as well as in cases which recovered?—Yes.

27,052. It was an almost invariable consequence of the injection of the serum that the temperature fell?—No, I could not go so far as to say that. I had cases which were treated with ordinary methods where the temperature also fell. It is certain that in ordinary cases the temperature falls under the action of the first injection, and it is equally certain in many cases it never re-ascends. This fall in temperature is obtained whatever the day of the disease on which the treatment is commenced. The most characteristic signs of the beneficial influence exerted by the serum are: fall in temperature; amelioration of the general condition; diminution of stupor and improvement in prostration. The improvement in the general condition, like the fall of temperature, is, in the majority of the gravest cases, apt to be transitory; the symptoms again become serious, and the disease appears to run its course as if the serum had not been given.

27,053. Did you find that the beneficial effects were most likely to be obtained if you commenced the treatment early?—Yes, the earlier the cases are treated the more is the intensity of the symptoms and the progress of the disease diminished. In cases which appear certain to die, the course of the disease seems to be stayed, and even if recovery does not take place, it nevertheless provides a most powerful resistance to the disease, and one which may last a considerable time. That remark was made on account of a very serious case which came in and which seemed to be kept alive by the administration of serum, and which eventually died. That was one case among others.

* *See* App. No. LXXXV. in this Volume.

27,054. What is your general conclusion?—I submit that if the treatment by serum is ineffective in a certain number of the worst cases it has an enormous power over those where the toxine poisoning is not of the gravest, and where the disease does not run its most rapid course. In these cases we are bound to admit that the recovery is due to the serum.

27,055. Is it your opinion that if you could have given larger doses the results would have been still more satisfactory, or do you think you attained the maximum dose which it was requisite to administer?—That is a difficult question to answer. The reason we did not give any larger doses was because in certain cases a kind of synovitis developed in various joints—in the elbows and wrists, and it was doubtful whether this synovitis was part of the plague itself or whether it was produced by the large doses of serum administered. That is why the doses were not increased.

27,056. Did these large doses have much effect on the heart so far as you observed?—No, I have no observation to that effect.

27,057. You have taken the pulse rate?—Yes, they are all recorded—the pulse, the temperature, and respirations.

27,058. These do not show that any effect was produced by the large doses of serum?—As far as I remember, no.

27,059. Was there much local effect produced at the seat of injection?—None whatever.

27,060. Even by the maximum dose?—None whatever.

27,061. What was the maximum single dose?—I went up to 60 c.c.

27,062. Even 60 c.c. produced no local disorder?—Not the slightest.

27,063. No complaint of pain?—There was a certain amount of pain, of course.

27,064. The swelling subsided *spontaneously* and rapidly?—Yes.

27,065. I see you have also made some experiments on animals. That is with the same serum, I presume?—Yes.

27,066. What animals did you use?—Mice, rats, and two monkeys.

27,067. Will you put those experiments in?—Yes.

EXPERIMENTS ON ANIMALS made with SERUM ANTIPESTEUX (No. 31).

(I.)

Mouse No. 1.—Inoculated with plague culture under root of tail, 5 minutes after received $\frac{1}{10}$ c.c. serum.—Result, died in 3 days.

Mouse No. 2.—Inoculated with plague culture, 5 minutes after received $\frac{1}{10}$ c.c.—Recovered.

Mouse No. 3.—Inoculated in same manner, 20 hours after received $\frac{1}{10}$ c.c.—Died in 90 hours.

Mouse No. 4.—Inoculated in same manner, 20 hours after received $\frac{1}{4}$ c.c.—Recovered.

Mouse No. 5.—Inoculated in same manner.—Received no serum, died in 42 hours.

(II.)

Mouse No. 1.—Inoculated with blood of a rat dead of plague, 20 hours after received $\frac{1}{4}$ c.c.—Died in 7 days. Neither examination of organs nor cultures showed plague bacillus, nevertheless there was reason to believe death due to plague.

Mouse No. 2.—Inoculated in same manner. Received no serum.—Died in 60 hours.

(III.)

Mouse No. 1. Inoculated with lymph from a human plague pustule containing enormous numbers of bacilli, 24 hours after received $\frac{1}{4}$ c.c. serum. Recovered.

Mouse No. 2.—Inoculated with same lymph. Received no serum.—Died in 76 hours.

SERIES made with SERUM (No. 88).

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(I.)

Mouse No. 1.—Inoculated with culture from human bubo, 20 hours after received $\frac{1}{4}$ c.c.—Recovered.

Mouse No. 2.—Inoculated in same manner. Received no serum.—Died in 72 hours.

(II.)

Rat No. 1.—Inoculated by subcutaneous injection with $\frac{1}{10}$ c.c. of the blood from the heart of a mouse dead of plague, 24 hours after received 2 c.c. serum.—Recovered.

Rat No. 2.—Inoculated in same manner. Received 36 hours after 2 c.c. serum.—Died in 96 hours.

Rat No. 3.—Inoculated in same manner. Received no serum.—Died in 71 hours.

(III.)

Monkey No. 1.—Received by subcutaneous injection the half of a mixture made by crushing up in 2 c.c. of sterile water the spleen, heart, and liver of a mouse which had died of very virulent plague, into the right thigh:—

After 12 hours.		An enormous femoral bubo appeared.
,,	18 ,,	High fever, walked with difficulty, and refused food.
,,	24 ,,	Received 2 c.c. serum.
,,	49 ,,	Not much change, difficulty in walking increased.
,,	,, ,,	Second injection of 20 c.c. serum.
,,	66 ,,	General improvement.

On the 4th day began to eat again, bubo increased in size, commencing to break down.—Complete recovery, 10th day.

Monkey No. 2.—Received same quantity of same preparation at same time:—

After 12 hours.		Bubo in right thigh.
,,	24 ,,	Fever less marked than No. 1.
,,	36 ,,	Difficulty of walking increased.
,,	48 ,,	Could scarcely move.
,,	66 ,,	Died.

27,068. In the first group of experiments you gave the serum first?—Yes.

27,069. How many experiments did you make?—There were five.

27,070. How many died, and how many recovered?—Two of them died, and three recovered.

27,071. Did you have any control experiments to show the quantity of the plague virus which would probably have killed each of these animals, without the serum?—Yes; Nos. I 5, II 2, III 2.

27,072. Did you satisfy yourself in each of these cases that a lethal dose of plague virus had been administered?—Yes, certainly.

27,073. Did you give much above the minimum lethal dose?—That I cannot say.

27,074. You have no idea what the minimum lethal dose of the virus may be?—No.

27,075. Then how can you say that it was above the minimum lethal dose?—It was sufficient to kill those that received no serum.

27,076. It might be that some of these recoveries were not due to the serum at all, but to the fact that the dose had not been a lethal dose?—Not probable.

27,077. It seems a fundamental requirement that that should be shown?—Yes, it does.

27,078. The next series you made was where the serum followed the administration of the virus?—Yes.

27,079. They were actually therapeutic experiments, I think; that is to say, the treatment followed the reception of the virus?—Yes.

27,080. Did you make many of that description?—No, not many.

27,081. How many did you make in the case of mice?—Three.

27,082. What were the results of these experiments?—The greatest result was that the administration of the

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serum either prolonged the existence of the animals, or that they recovered.

27,083. The first two died?—Yes.

27,084. Only one recovered?—Yes.

27,085. You do not state how much of the virus you gave in these cases?—No.

27,086. You did make an attempt, no doubt, to give a similar quantity. How did you weigh the virus? How much did you give of the culture, for example?—At the time these were done, we had no notion what the lethal dose was by actual measurement.

27,087. I thought that for any given virus you might have roughly ascertained what the lethal dose was. You did not do that?—No.

27,088. In the next series, you made some experiments on rats; three experiments?—Yes.

27,089. There were actually two experiments with serum?—Yes.

27,090. One died, and one recovered?—Yes.

27,091. You state that one-twentieth of a c.c. of blood was used in the first instance?—Yes.

27,092. How much did you use in the second instance? Was it done in the same manner, with the same quantity?—Yes.

27,093. And the same blood?—Not exactly the same manner.

27,094. But was it exactly the same blood as the first of these experiments?—Yes.

27,095. And the same dose?—Yes.

27,096. Perhaps you had better put that more definitely when you correct your evidence. The "same manner" does not quite cover the whole of the conditions?—I will do so. (Note by witness on correcting proof of his evidence:—All three rats were inoculated by subcutaneous injection with one-twentieth c.c. of the blood from the heart of a mouse died of plague.

No. 1 received 2 c.c. serum 24 hours after inoculation.
No. 2 " " " 36 " " "
No. 3 " no serum).

27,097. In the third experiment, I presume you gave the same blood?—The same dose and the same blood.

27,098. And the animal died?—Yes.

27,099. How do you explain the death in the one instance, and the recovery in the other, if the conditions of the experiments were absolutely the same?—Because one of them received the injection 24 hours afterwards, and the other 36 hours afterwards.

27,100. That certainly makes a considerable difference?—Yes.

27,101. They were not exactly comparable?—The time in which the one received the serum was earlier than the other.

27,102. How many experiments on monkeys did you make?—Only two.

27,103. What were the experiments?—The mixture was divided into two, and an equal part was given underneath the thigh. The mixture was made by crushing up the spleen, heart, and liver, of a mouse which died of virulent plague.

27,104. By subcutaneous injection?—Yes, injected into the thigh.

27,105. In the first experiment, you gave 2 c.c. of serum 24 hours afterwards?—Yes.

27,106. What was the result?—The results are all stated in the details which I have put in, and the symptoms which were produced on each inoculation are given.

27,107. In the second experiment the monkey received the same dose of virus?—Yes, without any serum at all; he got gradually worse.

27,108. The monkey died in 66 hours?—Yes.

27,109. What were the weights of these monkeys?—I cannot remember that, they were the ordinary "Guzarati" monkey.

27,110. They did not differ much in weight?—No, they are both exactly the same size.

27,111. You think they were about the same size?—Yes.

27,112. That question of weight would make a considerable difference. If there was much difference in the weight of the animals, the results can hardly be compared?—The monkeys were not weighed, but they were of the same class.

27,113. You know, roughly, they were about the same weight?—Yes.

27,114. Therefore, they are probably comparable?—Yes.

27,115. So far as they go, these experiments seem to indicate some curative power?—Yes.

27,116. You gave, in all, 22 c.c. of serum?—Yes, a small dose at first, and then a big one when he began to get worse.

27,117. You have had some opportunities of observing the effects of segregation, I believe?—Yes.

27,118. Will you describe what the segregation consisted of?—All the ports of Cutch were closed to passengers, except Cutch Mandvi and Khari-Rohar. At Mandvi no steamer was allowed to disembark between 6 p.m. and 6 a.m. All passengers from Bombay and Karachi were taken direct to the segregation camp on the Bandar through an alley way specially railed off. The age, caste, father's name, place of departure, and destination of each passenger was taken and registered. The register was called over at uncertain times to see that all passengers were present. The method for the disinfection of clothing consisted in boiling in large copper vessels, and, in the absence of any special dry air or steam apparatus, was found very efficacious. Perishable articles likely to be destroyed by boiling were exposed to the sun daily. It was only at Cutch Mandvi that the people were segregated, that is, where they were thoroughly segregated. Khari-Rohar was not under my supervision, and I am not aware what was done there. I believe the people were segregated in a rough manner, but there was no stringency whatever about the rules.

27,119. All the passengers were examined?—Yes, they were all examined by English nurses, and then from the examination on the quay they were taken through the Custom-house—where all their things had to be examined by the Customs authorities—into the segregation camps which were all carefully railed off. There were four or five large "dharamsalas,"—stone buildings—and every accommodation was given there for providing food and everything that they wanted.

27,120. Were all passengers segregated, or did you select certain of them for segregation?—They were all segregated.

27,121. For what period of time?—That varied. When the plague was bad they segregated them for 20 days, and later, when it got less virulent, 10 days. It was 10 and 20 days.

27,122. How many people did you deal with in that way?—The segregation camp opened on October 7th, 1897, and closed on the 22nd July 1898, during which time 15,958 passengers passed through; 178 were sent to the observation hospital, and 22 to the Plague Hospital.

27,123. Plague developed in 22?—Yes.

27,124. But 178 had symptoms suggestive of plague?—Yes.

27,125. You say that these 178 were sent to a separate place?—Yes, they were sent to the observation hospital away from the rest to see whether they developed plague or not.

27,126. And 22 of them developed plague?—Yes; cases of illness were sent originally to the observation hospital, and then from there they were drafted into a separate Plague Hospital which was nowhere near the segregation camp.

27,127. Of these 22, how many died, and how many recovered?—19 died, and 3 were discharged.

27,128. Have you had any experience of Haffkine's prophylactic fluid in Cutch?—None at all.

27,129. Did you use the serum from Paris as a prophylactic?—Yes, a certain amount of it was used.

27,130. How many persons were treated with it?—Owing to the objections raised by the Cutchis, serum, as a preventitive, was not used to any considerable extent. 1,044 persons of all ages were inoculated, of

whom five were afterwards attacked with plague. I put in a table showing those who were attacked :—

		Inoculated.	Attacked.	Result.
*(1.) Aisanbar -	Mundra Borah Caste.	14.9.97	26.9.97	Died 28.9.97.
*(2.) Kharmji -		"	"	Died 1.10.97.
(3.) Esmailyi -		"	25.10.97	Recovered
(4.) Isayi -		"	16.10.97	"
(5.) Mahomed -		"	"	"

* Brother and sister both attacked 12 days after inoculation. Their mother was attacked with plague two days after the children were inoculated.

27,131. How many of the plague cases died in which serum had been used as a preventive?—Two died and three recovered.

27,132. In the fatal cases was there any beneficial effect, as far as you could observe, from the injection of the serum? — Not that I could see. The only point was that the brother and sister were both attacked 12 days after the inoculation, and the mother was attacked with plague two days after the children were inoculated. It is quite possible that they may have had plague if they had not been inoculated with this preventitive serum.

27,133. Do you know the interval of time in each of these five cases between the injection of the serum and the occurrence of the plague?—Yes, they were all inoculated on the same day, and the dates are given.

27,134. What dose of serum was given?—Ten c.c.

27,135. One injection?—Yes.

27,136. (*Mr. Hewett.*) Did you find in the first epidemic that many cases of plague occurred in the same house?—Yes.

27,137. I mean when people were left alone in their houses?—In the earlier part of the epidemic there were more cases in one house than there were later.

27,138. Did you find any difficulty in recognizing the disease?—Roughly, I say not.

27,139. Do you think that many cases escaped detection by reason of their not being recognized?—Most of the cases which I saw were brought to me in hospital. Whether cases escaped the search parties I do not know at all. I do not think that many cases which were brought to hospital were missed because they were not plague. One was constantly going to houses to decide whether cases were plague or not, and I should be inclined to think that very few of them were missed, because if there was any doubt about it they were either removed to the observation hospital or to the Plague Hospital.

27,140. (*Prof. Wright.*) Were there many cases which had no buboes which were diagnosed as plague?—Yes, there were a great many.

27,141. Had you any difficulty in differentiating these non-bubonic cases from other diseases?—One had a certain amount of difficulty in some cases. Some of them were easy enough. The pneumonic cases were easy enough, but, of course, one did get a certain number of cases in hospital which were undoubtedly malarial, and then there was a difficulty in differentiating them from plague during the early stages. One had fevers of various kinds brought into hospital, and those, in some cases, were treated by serum and afterwards discovered to be malaria, and then they were eliminated from the list.

27,142. (*Mr. Hewett.*) And any inexperienced medical man might very easily think that cases were plague which were not plague?—Yes, many of the native assistants sent all kinds of cases into hospital which were not plague, and which had to be sent out again.

27,143. In the course of your service with the British troops in India did you come across cases in which soldiers got these buboes?—Yes. I treated two of them in Kolaba Hospital. That was where I got it myself. I got it from one of those men.

27,144. You had plague yourself?—Yes.

27,145. And these men also had plague?—Yes.

27,146. (*Prof. Wright.*) When was the epidemic worst in Cutch Mandvi?—I cannot remember the dates. It was worst when I first went up there in May and June.

27,147. Was it getting better by August?—Yes.

27,148. Your first 100 cases which you took as controls to the serum cases were cases which you took in May?—Yes.

27,149. Would there not have been a greater mortality in May and June, when your control cases came under observation, than in July and August when your serum cases were observed?—Yes.

27,150. If these 100 cases had not been treated with serum would you not expect to get a smaller mortality among them than among the 100 cases which you take as controls?—Yes, but not so small as after the use of the serum. If you like I will send you up 100 cases which we got later on still, and 100 of those which were inoculated later. Perhaps they will be more favourable for the purpose of comparison than those two groups. These were the first 100 cases which were admitted into the hospital.

27,151. Can you give us cases which were not treated with serum which occurred within the same dates as your serum cases?—Yes, that is what I will endeavour to do. (The witness intimated later that the list was not available.)

27,152. Do you know whether it will make much difference in the results? You have not worked that out, have you?—A certain amount of difference, possibly, but not much. The mortality is always heavier at the beginning of the epidemic than at the end.

27,153. Did you take every case and inject it with serum, or did you leave a certain number in the hospital un-injected with serum during those months of June, July, and August?—There were possibly some who objected to be inoculated, but, as far as I remember, all were inoculated. Of course a certain number were bound to be in the hospital which were not treated, because they might have been brought in after four days, or moribund, or brought in for diseases which were not known for certain to be plague. A certain number of that class were bound to be in the hospital.

27,154. How, then, can you furnish control cases which are strictly comparable to these serum cases?—Only by giving, as you suggest, those who were admitted about the same dates.

27,155. Did you get out your serum direct from the Pasteur Institute?—Yes, it came direct from the Pasteur Institute.

27,156. Was it sent to you direct?—Some was sent to me and some of the serum was that which Yersin left when he went away. Yersin come up for a few days and did some experiments, and then he was recalled.

27,157. Do you think you can give such particulars as will suffice to identify the particular serum which was used? We can then inquire at the Pasteur Institute as to how the serum which you employed was prepared?—That is so. (Witness intimated later that no particulars were obtainable.)

27,158. Were a whole series of sera employed for your injection?—Yes.

27,159. Do you know whether they all come from horse No. 31 whose serum you tested on animals (*see* Question No. 27,067)?—Oh no, they came from various horses.

27,160. Then the serum which was employed for your animal experiments was not the only serum which was employed for your therapeutic inoculations on man?—No.

27,161. It was only one of the sera which you employed?—Yes.

27,162. Can you particularise the cases which were treated with this particular serum?—No.

27,163. They were all mixed up?—Yes, as they came out they were used.

27,164. (*The President.*) Have you not a special note on the record of the case indicating what serum it was?—No.

27,165. (*Prof. Wright.*) I notice that in the third series of experiments which you put in you say: "One "mouse was inoculated with material derived from a "human plague pustule"?—Yes.

27,166. Could you tell us in connection with that, what eruptions you have seen in connection with

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plague? Have you seen a pustule eruption?—No, I mean the plague pustule which starts with a large black bleb, and which goes on to necrosis.

27,167. With regard to these carbuncles, do they, in your experience, invariably occur at the very beginning of the plague attack, or do they occur also during the course of the plague attack?—As far as I remember, I have seen them on patients when they were admitted into hospital, on the body at various places, and others where they developed after the patients came into hospital.

27,168. You do not adopt the view that one of these phlyctenules indicates the original site of infection?—No, they are part and parcel of the plague itself.

27,169. Was the synovitis which you speak of ever complicated with urticaria?—No.

27,170. Did synovitis ever occur when you gave as little as 10 c.c. of serum then?—No. I am not at all inclined to say that it was due to the serum at all, except that it was an observation made after big doses in a few cases that this synovitis resulted, and we thought that possibly it was due to those large doses.

27,171. You speak in your précis of pyæmic plague occurring in association with abscesses all over the body: did these abscesses occur in association with buboes?—No; I called to mind one case of necrosis of the scalp—three or four places in the scalp where abscesses developed and left a large necrosis as big as a five-shilling piece.

27,172. Is this not similar to the carbuncle you have spoken of previously?—No.

27,173. It was a different kind of abscess?—Yes.

27,174. Was corpse inspection resorted to in Cutch Mandvi?—Yes. We went to see cases of people who had died to verify whether it was plague or not.

27,175. Was an objection ever made to your inspecting the corpse?—None whatever.

27,176. Were objections not raised among the Muhammadans?—No.

27,177. Have you ever noticed any œdema on the chest of people who died of plague?—Do you mean œdema extending from buboes?

27,178. That is a moot point. I understand that in cases of axillary buboes the œdema may extend right over the front of the chest?—Yes.

27,179. I am inquiring, however, with regard to cases of pneumonic plague and inguinal plague. Œdema of the chest has been asserted to occur in such cases; has that come under your observation?—Never with pneumonic plague, but in many cases of inguinal and axillary bubonic plague.

27,180. Do you think much importance is to be attributed to the œdema as a sign of plague?—No, because so far as my experience goes you get a bubo first, and then the œdema extends from the bubo.

27,181. You have not found this œdema in septicæmic cases of plague?—No.

27,182. With regard to pneumonic plague have you ever seen complete solidification of the lungs?—I have had very little experience of *post-mortems*.

27,183. But have you ever seen dulness extending all over the chest?—As far as I remember there were only a few cases. One side was completely dull and no breath sounds at all.

27,184. Those cases are of very rare occurrence are they not?—Yes, the great majority are of the lobular form.

27,185. Is it difficult to distinguish between the septicæmic form of plague and the pneumonic?—Yes.

27,186. Very difficult?—Yes.

27,187. Do you find that nearly every case of septicæmic plague is complicated with some pneumonic symptoms?—Yes.

27,188. You would not make a special category of pneumonic cases of plague, would you?—No.

27,189. You do not see your way to make these different categories of bubonic plague and septicæmic plague and pneumonic plague?—No, it is all plague.

27,190. (*Mr. Cumine.*) Were there private caste hospitals at Mandvi when you were there?—Yes.

27,191. How did the willingness of the people to be taken to these non-official hospitals compare with their willingness to be taken to the Government hospitals?—Most favourable for the caste hospitals. We had no difficulty in getting them to the caste hospitals, but very considerable difficulty in getting them to the Government hospitals.

27,192. (*The President.*) I want to make one point clear. Did the synovitis which you observed in plague cases occur only in those who had received injections of serum?—Oh no: one gets synovitis in cases treated with ordinary methods as well. That is why I made it a point that it is not certain that it is due to the large doses of serum. But it was curious that one found synovitis when large doses were given, and one also found it when there was no serum given.

27,193. Can you go so far as to say that the synovitis was more frequently seen in those cases where you gave large doses of serum?—I cannot say that.

27,194. It might be a coincidence?—Yes. Whether it was due to the serum or not I am not prepared to say.

27,195. In the cases treated with serum in which synovitis appeared, did the synovitis appear only when large doses were given, or also with small doses?—As far as I remember, only where large doses were given.

(Witness withdrew.)

Major R. W. S. Lyons, I.M.S. called and examined.

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27,196. (*The President.*) Are you in the Indian Medical Service?—Yes.

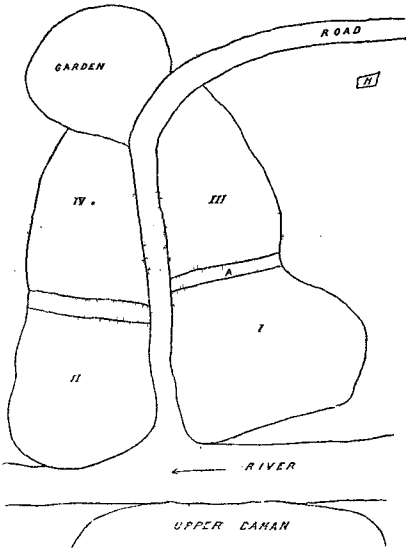
27,197. What are your medical qualifications?—I am M.D. of Queen's University, Ireland.

27,198. (*Mr. Cumine.*) Did you go to Daman?—Yes.

27,199. To inquire into inoculations there?—Yes.

27,200. Will you tell us how you conducted the inquiry?—Yes.

27,201. Did you go to every house in the town?—Perhaps I had better begin at the beginning. You have been to Daman, and you know that it is an ordinary native town with one large street down the centre, and a cross street dividing it, somewhat unequally into four parts. The road to Daman curves round in this way—



I started by taking *this* (I) section. With a few exceptions, the people are very poor and live in small houses, generally of one room each. Sometimes there is a room behind the front room, and running along the front is a verandah. I went to the first house and inquired if there were any inoculated people there, and, if so, had any attacks of plague occurred among the members of the family. They told me whether there had or not, and then, if attacks had occurred, I found out whether they had occurred before or after the inoculation, and whether among the inoculated or uninoculated. Then I inquired if they knew if there were any inoculated in the next or adjoining houses. I did this at each house, so as to make as certain as possible that I did not allow any to escape me. I went through each section of the town in this way. *These* streets divided them very fairly. *This* (IV.) is the smallest division, because this garden contained a large number of people whom I could get hold of at the same time. They were people employed in the garden, and who lived in little huts all around, as gardeners do in India. *This* (IV.) was my last day's work. I finished early and went to some shelter evacuation huts which had been put up in the fields about *here* (H), not far from the road.

27,202. Did you go to every house in the town?—So far as I am aware I visited every house in the town, with the exception of that in which Dr. Fernandez, the man who assisted me, lived. I got information from a person in each house as to what the results were there. They might have deceived me if they wished to do so, but they had no reason to, and Dr. Fernandez had no reason to deceive me with regard to his own house.

27,203. What I wished to get clear was the extent to which you went to all the houses. You say you went to every house in the town?—Yes.

27,204. Not merely to those houses in which, there being both inoculated and uninoculated persons, you were informed that an inoculated or an uninoculated person had been attacked with plague?—No. My first inquiry was: had any inoculations been done in the house?

27,205. (*Prof. Wright.*) Does that refer to Upper Daman or to Lower Daman?—Lower Daman.

27,206. Is Upper Daman part and parcel of the same town?—No. It is separated by the river from Lower Daman. Upper Daman is quite a small place, composed of a fort, with a small number of houses outside the fort.

27,207. Were any inoculations done in Upper Daman?—I do not know. Our inoculations were done only in Lower Daman. When they were started the Governor had placed a cordon along the river to cut off all communication between Upper Daman and Lower Daman.

27,208. There were no inoculations in Upper Daman?—I cannot say. We sent the Governor a certain amount of serum for inoculation; but whether any were done or not in Upper Daman we were not informed.

27,209. Is the population of Upper Daman included in your estimate of the population?—No, it is excluded.

27,210. (*Mr. Cumine.*) Did you make out investigation sheets?—Yes.

27,211. Did you bring into these investigation sheets all the houses in which inoculated people lived?—No, only those families in which plague cases had occurred, and in which inoculations had been done. *This* particular street (A) had the worst outbreak of plague of any that I found. In *this* street there were two or three houses, in each of which all the inhabitants had been inoculated; and all had escaped plague entirely. They were the only houses in the street which escaped plague entirely. It was a most convincing example of the benefit of inoculation to anyone who saw the surrounding circumstances; but this cannot very well put it on paper statistically.

27,212. To what extent did you see other inoculated persons who are not brought into your investigation sheets, and to what extent did you find out, by actual investigation, what had happened to them?—I merely inquired at each house if plague cases had occurred. I did not examine each individual who was inoculated.

27,213. When we see in your investigation sheets that in a certain house in Daman three inoculated persons were living, and that one had plague and recovered, are we to understand that you made these entries because you saw these three persons in the house, and actually saw the person alleged to have recovered, or merely that you were told that these people were living there, and that one had had plague and recovered?—In each house I obtained from one person, who was fairly intelligent, all the information.

27,214. (*Prof. Wright.*) How was the population arrived at?—That was a difficulty, as there was no census. The population was obtained from the Governor. The Governor told us there were 12,000 people, as far as my memory goes, in Lower Daman. (Note by witness on correcting proof of his evidence:—This statement is wrong. The Governor told me that the population of Daman was about 11,000, not 12,000.)

27,215. I think you put it down at 10,900?—Yes; we took the liberty of cutting it down. (Note by witness on correcting proof of his evidence:—We believed that the population of the town was reduced by 1,000 deaths at least, from plague, during the month of February.)

27,216. But that improves your statistics?—No, it brings them down.

27,217. The larger the population the smaller is your percentage of mortality?—On the total population, yes.

27,218. So that, if you cut down the population from 12,000 to 10,000, you improve the statistics, since your uninoculated population is got by subtracting your inoculated population from your total population?—We cut off 1,100. I think, if you had gone through Daman,

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would have thought that we estimated the population fairly correctly.

27,219. I am not calling that in question, but we want to get at the exact facts. I want to know how the population was arrived at. Your statement as to the number of the inhabitants is worth more to me than the Governor's if you tell us how you arrived at your estimate?—I personally thought, and Mr. Sorabjee Damaun Wallah, who knows Daman, ultimately also thought, that 12,000 was too high.

27,220. I have an intimate knowledge of certain towns, and yet I have no idea as to what is the exact population of those towns?—That was our difficulty in this case. There is no census.

27,221. I want to know how these figures, which you put in, were arrived at?—There was no census so far as I am aware. I tried to get a census.

27,222. What did you substitute for a census?—We substituted that 10,900.

27,223. How did you arrive at that figure?—We arrived at it partly from the Governor's statement, which was 12,000 (*see* note by witness to Question No. 27,214 above) and from the estimate of Mr. Damaun Wallah, which was 11,000. (Note by witness on correcting proof of his evidence:—This statement is wrong. Mr. Damaun Wallah estimated the population at about 10,000.)

27,224. You have estimated it at a little less than either?—Yes.

27,225. What principle did you take as your guide in cutting the population down?—None.

27,226. Is then your estimate of the population anything more than a guess?—It was quite a guess.

27,227. Then what is the meaning of your working out your percentages to the decimal point?—I think there is. One must take some standard to go by, one must have a standard whether right or wrong, and even if one argues out statistics from a false standard one gets an impression not exactly right, but one does get an impression in which there is an uniform error all through.

27,228. But it may be evenly wrong in favour of the inoculations as well as against them. Your statistics are worked out here to decimal places?—With regard to the inoculations, as far as I know, the results are absolutely correct.

27,229. But, first I want to get the facts about the population. You say 10,900 is the population. That is got at by guess?—That is so.

27,230. Then you subtract from this number 670 persons who you say died of plague before that time, how did you get at that figure?—I do not remember the figures now, it is two years since I worked them out.

27,231. As far as I understand from your printed report,* the Governor told you that the death-rate might be reckoned as averaging 30 a day?—Yes.

27,232. Further, the Governor told you that you might neglect all deaths before the 1st March?—We did.

27,233. The plague began on the 1st February, but, the Governor told you, you might neglect the deaths in February, and that you might estimate the deaths in March as averaging 30 a day?—Yes.

27,234. But when I take that estimate, and when I multiply by the number of days up to the 24th March, when the inoculation were begun, I make the deaths to be 720. You, on the other hand, arrive at the figures 670?—We lowered the estimate of the death rate to 26 a day, because Mr. Damaun Wallah——

27,235. Who is the Damaun Wallah?—He is the owner of about three-fourths of Lower Daman. He made a census of the families in which deaths occured, which gave the total number of deaths at 2,352.

27,236. Do you know how he made the census?—I believe he made it by collecting from house to house the reports of all the deaths.

27,237. We have it that the people emigrated in large numbers, were there not lots of quite empty houses in Daman?—Yes.

27,238. How then could the Damaun Wallah get at the correct number of deaths?—After the emigration had occurred, he could not obtain statistics. He made his census after the plague cordon was removed and when the people had come back to their houses, when there were no deaths in Daman, in fact, while it was plague-free, and the towns around were infected, so that he would probably have the greater number of his people back again. But, in any case, taking into consideration the fact that he may have made mistakes, he reduced the average to 26 deaths a day instead of 30 a day, that we estimated it at.

27,239. Then, you say 2,000 people left the place, was that a guess too?—Yes, although it is a pretty accurate guess, for the reason that it was so estimated by Mr. Judge, the Salt Commissioner, who was on the frontier, and who knew about the number of people who passed out each day.

27,240. He did not draw his cordon round Daman till later, did he?—Yes, there was always a salt cordon. The cordon was not closed with regard to people until he settled down there himself on a certain day.

27,241. Do you know how this estimate of 2,000 emigrants is arrived at? You say Mr. Judge knew. Did he give the information to the Governor or did the Governor guess?—As far as I remember I had the number from Mr. Judge, not from the Governor.

27,242. Did the people emigrate by sea as well as by land?—Almost all by land. I should think all by land, because with the exception of the fishing population they have no boats, and they could not get into Bombay or any harbour along the coast, coming from a plague-infected place.

27,243. Do you know anything about the strength of the vaccine which was employed at Daman?—No.

27,244. Was the strength of the vaccine experimentally tested?—I do not know, I am not a bacteriologist.

27,245. Are you able, in your statistics, to separate the persons who were vaccinated in the first series of inoculations from those in the second and third series? When you say that 1,372 persons were inoculated and that the mortality among them was 13 per cent., is it not true that these 1,372 are made up of two different lots, *i.e.*, of some who had been inoculated a month before, and of some two months before?—Quite so.

27,246. We have no data given here to enable us to determine whether the effect of the inoculation was less in the second month as compared with what it was in the first?—That is a thing which I would like to have done, but I will show you the difficulty. If you take any inoculation sheet you will see that some of the members of the family were inoculated once and some twice. If they had all only been inoculated once we could have followed out each series inoculated from beginning to end separately, that is to say, taking the total number inoculated on the first occasion we could have followed out their statistics separately and kept them apart from the number inoculated in the second series of inoculations. But a number were inoculated both times, both first and second. Supposing, in a house, every one wished to be inoculated, they would not want to have it done at the same time, because the inoculated were laid up for some days, and there would have been no one to cook or do the housework. Therefore, a certain number were inoculated, say this month, and next month some of the first series were in many instances inoculated again, and the remaining members of the family were inoculated for the first time.

27,247. With regard to these inoculations you say that Dr. So-and-so did so many on a particular date; I do not know whether the figures which are given refer to new people, or whether they include also second inoculations?—All the inoculations so referred to in these statistics are first inoculations.

27,248. And you have no reference as to second inoculations?—Oh, yes.

27,249. You have not put it into this statement?—No, you will find it in these sheets.*

27,250. But you have no statistical summing-up of the results attained by second inoculation?—No.

27,251. Then these results apply sometimes to people inoculated once and sometimes twice?—Yes.

27,252. Your report shows the effect of single, and in some cases of double, inoculations for a period of six weeks after inoculation?—Yes.

* *See* App. No. H, in Vol I. of these Proceedings.

27,253. You did not make any subsequent inquiry as to the fate of these people?—Daman was plague-free in June 1897, when this report* was drawn up and remained plague-free till I left in November. This investigation was made up to the 1st June, I think. Of course, I do not know what was done after I left India.

27,254. You say in your report that, although you have not determined the duration of immunity, the facts you have collected show that the question has lost its urgent interest. What is the meaning of that?—My idea is, that if a way has been found of preventing plague from spreading, that is all that is required.

27,255. But in the case of Bombay, where you have plague lasting for a long time, do you think that an immunity, which lasted for six weeks and no longer than six weeks, would be of any avail?—We do not know that protection lasts only for six weeks, but even so, why should they not get re-inoculated every six weeks when plague is prevalent around them?

27,256. Cannot you give us any data with regard so the duration of the immunity?—No. That could have been done at Tarapur. I inoculated about 600 people there myself in 1897, and they had a second outbreak at Tarapur in the following year.

27,257. You say a weaker vaccine was used for the second and third inoculations, and you say that, in consequence of this, much larger doses were given?—Yes. It did not give as favourable results as the more powerful inoculation.

27,258. It did not give as great a clinical reaction?—That is so.

27,259. Do you know why the dose was not increased until it did give as satisfactory a clinical reaction as the first and stronger vaccine?—Yes, I do partly. The inoculations were being performed by native doctors, and we did not trust them to investigate the clinical effect of increased doses.

27,260. I do not quite see the bearing of that. Do you mean you would not take their word that the reaction which was obtained was slighter?—No, we did not trust them to increase the doses. I know from the inoculations I did myself that the reactions were not equal.

27,261. But, if you had known that at the time, you would, would you not, have increased the dose?—I did afterwards, but I never got the same re-action.

27,262. Why did you not increase until you got the reaction you desired?—I was not sufficiently acquainted with the action of these toxines to do that.

27,263. I understand that at first the standard dose of 2½ c.c. was given?—Yes.

27,264. In the second and third inoculations you gave two or three times as much?—Three, four, five, or six times as much.

27,265. That is, you gave 12½ c.c.?—Yes, more than that. I have given 15 c.c.

27,266. You did not give 30 c.c. because you thought there might be risk?—Yes.

27,267. Did you take the temperatures of these people when you inoculated them?—Yes, I took a certain number. With the weaker serum, frequently, I did not get a temperature more than 99°, rarely over 100°, whereas with the stronger serum one got a temperature rarely under 101°.

27,268. I do not see specified here what inoculations you did—the second, third, and fourth series?—I never did any of those inoculations at Damaun.

27,269. Then you inoculated elsewhere with some of this same vaccine?—Yes, I did, in Bombay and on Europeans, where I had every chance of knowing exactly how the temperature was ranging.

27,270. Had you any opportunity of finding whether the Europeans you inoculated there did receive benefit from it?—No cases of plague occurred among them. Europeans seemed to be very little subject to plague in Bombay.

27,271. Have you any notion what the limits of error are in the estimates of population which are arrived at by guesses?—No.

27,272. We have had in evidence different estimates of the uninoculated population of Hubli, and these estimates varied between 500 and 8,000. Do you think that your estimates of population may be as wrong as some of these?—I would have a very poor opinion of the intelligence of a witness who could not distinguish between 500 and 8,000 persons.

27,273. You do not think there may be errors of this order of magnitude in your statistics?—No.

27,274. How many houses did you visit?—I have no idea. Purely as a guess, I should think I visited between 500 and 600 houses.

27,275. What would the population of those houses be?—I cannot tell you that.

27,276. You, practically, made a census of the town if you went round to every house?—That is not so easy as you appear to think. If one inquires at a house whether inoculations have been done there, and they say "No," one goes on to the next house at once. If one had to write down the name of every individual in the house, their ages, and so forth, one would spend a quarter of an hour, or half an hour, according to the number of people there.

27,277. You could average the number of inhabitants in the houses?—You will see by the sheets that they varied enormously.

27,278. I say you could strike an average?—Some were 21, and some four, and so on. If one rejected the highest and the lowest number, and struck a mean for the remainder, one could have got an average; but I was not looking for that.

27,279. You cannot supply us, can you, with the number of houses which you visited, so as to enable us to construct some sort of census by multiplying the number of houses by the average number of inhabitants as shown in your investigation sheets?—No.

27,280. (*Mr. Cumine.*) Can you tell us, from this Report* (*handed to witness*), the percentage mortality during the time they were under observation, amongst the total uninoculated and the total inoculated, separately?—24·6 per cent. for the uninoculated, and 1·6 for the inoculated.

27,281. Can you tell us what is the mortality of the uninoculated and the inoculated in your investigation sheets?—For the uninoculated it was 43·5 per cent., and 20 per cent. for the inoculated.

27,282. That is the percentage of attacks; will you mention the percentage of deaths?—29·8 per cent. deaths in the uninoculated, and 8 per cent. in the inoculated.

27,283. The mortality rate among the inoculated in your investigation sheets would be some five or six times higher than that among all the inoculated? It is 8 per cent. among the people in your investigation sheets, and only 1·6 per cent. among the total inoculated; so it is five or six times higher among the former, is it not?—Yes.

27,284. Therefore, it becomes important to see to what extent you ascertained what had happened to the inoculated people who did not come into your investigation. Were there a certain number of inoculated people not in your investigation sheets about whom you did not manage to find out anything at all, whether they were alive or dead?—No, I inquired at each house if inoculations had been done, and whether cases of plague had occurred.

27,285. At some of the houses to which you refer, were you unable to get any information about a certain number of the inoculated people?—No; I asked whether any cases of plague had occurred, and if no plague cases occurred I did not inquire further.

27,286. How did you know whether any plague cases and occurred or not?—I had to depend on the statement of the people in the house. There is a reason, of course, why the death-rate should be higher in the 84 houses to which these sheets refer, because they were plague infected. Where a case of plague occurs in a house it is generally found that plague spreads right through the house; where a case of plague has not occurred the house may escape scot-free, although plague is all round it.

27,287. (*Prof. Wright.*) Cannot you also test your results in another way? What is the relative mortality of the inoculated and the uninoculated as recorded in your investigation sheets, and how does this compare with the relative mortality among inoculated and uninoculated in the general population?—Are you referring to the inoculated and uninoculated as a whole.

* *See* App. No. II. in Vol. I. of these Proceedings.

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or those in the houses where plague cases have occurred, or where inoculations were done?

27,288. I understand that the mortality from plague will be greatest both among the inoculated and among the uninoculated when there is a case of plague in the house?—Yes.

27,289. And the inoculated and uninoculated alike will have a better chance of escaping plague if there are no cases of plague in the house where they are living?—Yes.

27,290. Therefore, let us determine the number of the plague deaths among the inoculated and uninoculated in the plague houses, and let us compare that with the number of deaths among inoculated and uninoculated who were not living in plague houses. Can you supply me with these figures? You have stated in your tables that there was a death-rate of 8 per cent. among the inoculated; what was the death-rate among the uninoculated in these houses which you have tabulated?—29·8 per cent.

27,291. That is practically 30 per cent. The percentage among the inoculated for the whole town was 1·6 per cent; what was the percentage of the uninoculated for the whole population?—24·6 per cent.

27,292. Then the relation of the mortality of inoculated to the mortality of uninoculated in plague houses is 1 to 4, while the same relation all over the town was 1 to 15. These figures are, surely, not comparable?—I think you will see that 24·6 per cent. is the death-rate among the general uninoculated, which is lower than 30 per cent. among the uninoculated occurring in plague-stricken houses.

27,293. I am quite prepared to take that, but these cases of death among the inoculated which appear in your investigation sheet were brought to your knowledge by the fact that you made a census of the houses. But the cases of death among the inoculated in the town outside were not brought to your knowledge in the same accurate manner?—You must remember there are a great number of persons in the town who never come in contact with plague.

27,294. That applies to the inoculated as well as the uninoculated?—Quite so.

27,295. I take it that these investigation sheets are correct, and this being so, they ought to be a picture in small of what occurred in the whole of the town, ought they not?—Yes.

27,296. We find that they are not a picture in small of what occurred in the whole town?—I think I can show you the reason. In the plague-infected houses almost every person catches plague, in the town every person does not catch plague. The reason probably is that a great number of the inhabitants of the town have not come in contact with plague.

27,297. I do not see that this meets the point?—In order to get comparative statistics for the whole town I should have taken in a street say, four houses, in which inoculations had been done and compare them with four on the opposite side of the street in which, perhaps, every member had been attacked by plague, but I did not do this. I neglected those inoculated houses altogether in which plague did not occur. My object in selecting only plague-stricken houses in which inoculations had been done was not to find evidence in favour of inoculation, but all the evidence there was against it. I did the same in Bombay; I investigated every plague case among the inoculated there, and advertised for them in order to obtain all the evidence against inoculation.

27,298. I have had experience of the futility of the effect of advertising for information?—In Bombay I had particular advantages. I knew the majority of the medical practitioners, and anyone who was called in to a case of plague in which inoculation had been done always told me about it.

27,299. (*Mr. Cumine.*) There are four investigation sheets?—Yes.

27,300. Will you look at that Report* ?—I have the Report here. There are four sheets.

27,301. When the proof of your evidence is sent to you for correction will you put down with regard to each of these four tables separately the attacks and deaths amongst the inoculated and uninoculated respectively?—May I explain what these sheets are? In the first division all the families are shown in which inoculations were done on the first occasion in Daman. Through a printer's error two families which should have appeared in the first division are shown in the second. In this first series there are a considerable number of inoculations done on the second occasion—not the majority, but a certain number. In the second series there are no inoculations done on the first occasion, they are all inoculations done on the second occasion. In the third series they are inoculations done on the third, and in the fourth series on the fourth occasion, after the plague had stopped in Daman altogether, for a number of people were inoculated even after the plague ceased.

27,302. Do you think that any inoculated people could have emigrated? Were there any privileges given to inoculated persons?—Not from Daman.

27,303. (*Mr. Hewett.*) They could have emigrated, I suppose?—No, I do not think so.

27,304. Why not?—Mr. Judge kept a strict look out.

27,305. Do you think that a cordon can keep people in a place?—I do not think it can keep individuals in a place. But I do not believe that families escaped, although individuals may have done so.

27,306. (*Prof. Wright.*) Do you think that the inoculated in your investigation sheets are comparable, in the matter of age and health, with the uninoculated; or do you think that you have a greater number of the feeble and old people among the uninoculated?—If you look through these sheets you will see exactly. I have put down their ages in each case.

27,307. I only wanted to know whether, when you saw these people, you thought the uninoculated were comparable as a whole with the inoculated people. You probably saw them?—Yes.

27,308. Why were these people not all inoculated?—It not unfrequently happened that, when the members of a family went to be inoculated, one or more were left at home to attend to household matters.

27,309. (*The President.*) Why did they not go?—It is on account of family life in India.

27,310. (*Mr. Hewett.*) I think you did over 8,000 inoculations in Bombay City?—No, I did not do them. I did a certain number there. I think there were about 18, or perhaps 20, cases of plague which occurred among the inoculated in Bombay, and I found out from the people who treated them all about these.

27,311. You say that these 20 cases occurred; how do you gather that other cases did not occur?—That I cannot be sure of.

27,312. So that the facts would not bear so much upon the relative immunity of the inoculated?—Not on the relative immunity of the inoculated; but it did show a result which Daman did not show.

27,313. What was that?—In the 18 or 20, as far as I remember, there was no death.

27,314. At what period of the epidemic was that?—I came to Bombay on the 25th of January, and the plague was at its height in Bombay about the end of March or the beginning of April 1897. They occurred during that time.

27,315. Have you any security that the practitioners always gave you the cases which were unfavourable to inoculation?—They knew that I was looking for them. Of course, I have no guarantee.

27,316. These were native practitioners, were they not?—Yes.

27,317. Assuming that benefits were given to the inoculated persons, it would be to their advantage to let you see that the results of the inoculations were good?—There was no benefit to be given to inoculated persons.

27,318. There was subsequently, and there was some idea that there might eventually be?—My impression is—it is merely an impression—that the very opposite was the case—that the native practitioners sought out every possible thing they could against inoculation.

(Witness withdrew.)

* See App. H. to Vol. I. of these Proceedings.

Dr. KLEIN, F.R.S., called and examined.

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27,319. (*The President.*) You have been for years employed by the Local Government Board in biological research?—Yes.

27,320. (*Prof. Wright.*) Perhaps you will begin by telling us something of the morphological characteristics of the plague bacillus. I see* you lay great stress upon the fact that certain of the colonies which are produced on agar are thready colonies?—That was in gelatine plates.

27,321. Your experience was gained, was it not, by a study of two different cultures of plague?—Yes.

27,322. One of them was obtained from a plague case which occurred in London?—Yes, and one was sent from Hong Kong.

27,323. Have you verified that your observation holds true also in other plague cultures?—I have not had any others.

27,324. I do not think that in your Report to the Local Government Board you referred to the formation of stalactites in broth?—No.

27,325. Have you confirmed M. Haffkine's statement that a stalactitic growth is invariably obtained with cultures of plague?—I have not worked on the same lines. Owing to the Vienna scare, we were put in a very awkward position.

27,326. Have you verified Mr. S. Mervyn Gordon's statement that the plague bacillus possesses flagella?—Yes, but very few bacilli have a flagellum.

27,327. You do not lay any stress in your Report to the Local Government Board upon involution forms; do you think these involution forms are very common in cultures and very characteristic?—They are very common where the media is not absolutely suitable; for instance, in Hankin's cultures where there is an excess of salt.

27,328. Have you found that to be a good medium upon which to obtain involution forms?—Yes, but I have not had a sufficient number of human cases to make a series of observations upon. In those I have had before me there were no involution forms in the active cultures.

27,329. Do you know whether your cultures still give involution forms or not, or whether they have ceased to do so?—I have not tried that.

27,330. Do you know whether bipolar staining can be got in bacteria grown on artificial media?—Yes, constantly.

27,331. I ask because there is an impression that bipolar staining can only be obtained in the case of bacilli which are obtained directly from the animal?—No; I think bipolar staining is a very characteristic feature.

27,332. It is said that when the plague bacillus is transferred from agar to agar for a number of generations it no longer shows bipolar staining?—I doubt that. With regard to these bipolar stainings, it depends so much on the operator himself as to the way it is stained and the way it is washed afterwards. You can get from the same culture preparations which show these bipolar stainings, and in others slightly different you would not have it.

27,333. We had it in evidence that bipolar bacteria are often found in the earth; do you think that the fact that these bacteria showed bipolar staining would, by itself, justify the diagnosis of plague?—I should be very slow to do that.

27,334. Do you think that the clear space in the centre corresponds to a vacuole?—I think that it is due to the segregation of their protoplasm, and to the collection of this at the ends of the rod.

27,335. Could you see a clear space in the unstained bacillus?—I must say I have not done so.

27,336. You say the plague bacilli find their way into the intestines of guinea-pigs inoculated with plague?—Yes; we have made several experiments on that point with animals dying from plague after inoculation. In some instances the small intestine was found distended with some mucous matter, and we have made not only cultures successfully from it, but in several instances injecting a guinea-pig from this we produced definite plague.

27,337. Have you ever found that the plague bacillus escapes in the fæces?—We have not looked for it there. Only in the animals which died we took out matter from the intestinal canal.

27,338. Have found many plague bacilli in the intestinal canal? Were they in sufficient quantities to be seen under the microscope?—There are a great many other bacteria; but the best and easiest way of showing that they are the plague bacilli is to inject a little of the mucus into the subcutaneous tissue of a fresh guinea-pig.

27,339. Have you ever isolated plague from contaminated matter of that kind; is it easy to do so?—I think that when sufficient care is used there is no difficulty.

27,340. You found bacteria in the bronchial secretions of the guinea-pig?—Yes.

27,341. Did you find them in any of the guinea-pigs before they died of plague?—Only after death. Even in those cases in which guinea-pigs were dying within 48 or 72 hours, and were showing very little change in the lung, except a slight congestion—even in those cases—and those are the cases which are particularly referred to in my Report*—did the mucus in the trachea and the larynx yield cultures of the plague bacillus; where the lungs were greatly involved (inflamed) it is easy to demonstrate the plague bacilli in the bronchial contents.

27,342. You surmised, from your observations on guinea-pigs, that plague bacilli might be found in the human sputum?—Yes.

27,343. I understand that no example of a transference of plague from one animal to another came under your observation?—No.

27,344. Did you take any great precautions to prevent such a spread?—The usual precautions were taken. There is a room with hutches one above the other, in which the animals are placed.

27,345. Have you left infected animals in contact with non-infected animals?—Sometimes there are animals which are infected with material which proves to be non-virulent, and they are put together with animals which have been infected with material which proves virulent. When I say "non-virulent" I mean a material which I have tested and found to be non-virulent. The animals are put together, and the one with the virulent material dies, and the other does not become affected at all with plague.

27,346. But you have not kept quite normal animals in contact with plague-infected animals?—They are in those hutches above and below in the same room. There are animals which we call fresh animals which have not been touched, and we never had any of these becoming infected with plague.

27,347. Have you ever demonstrated the presence of agglutinins in case of plague in animals?—No.

27,348. Have you seen agglutinins developed in men?—No; I have never studied a case of plague in man.

27,349. Have you tested any of the sera sent out from the Pasteur Institute?—I have not seen any. I have myself had sera from guinea-pigs and rabbits.

27,350. Have you ever noticed that animals which received serum which had been drawn off from an animal which had previously been inoculated died faster than control animals? You refer to a case here, in page 296, of your Local Government Report,* Guinea-pigs Nos. 24 and 26. You say, "The result was "rather unexpected, inasmuch as both guinea-pigs "developed the typical disease. The serum-plus-"plague-guinea-pig No. 26 was indeed more severely "affected than the control animal; it died in 24 hours, "whereas the control animal died in 60 hours." You give an instance there of an animal in which the course of plague was apparently hastened by the introduction of a therapeutic serum obtained from an animal which you had endeavoured to protect?—Yes.

27,351. Have you seen such a result from the introduction of other ostensibly therapeutic sera?—I am sorry to say I know of cases where it does occur. There is on organism which I have worked with for the last three or four years, which is present in the intestine of acute diarrhœa, in fact, in all diarrhœa affections you find this organism abundantly present. It is an

* *See* App. B. No. 7 to the Supplement to the Report of the Local Government Board for 1896-7 containing the Report of the Medical Officer.

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anærobe and is spore-forming; we call it the bacillus enteritidis sporogenes. It is found in sewage, in street-dust contaminated with horse dung, and in human fæcal matter. Some of it is derived from a diseased alimentary canal. If a small part of such material is put into milk and the milk heated to 80° C., so as to destroy everything else but the spores themselves, it yields on anærobic incubation at 37° C. in 24 hours a pure culture of bacillus enteritidis sporogenes. This culture when injected into guinea-pigs invariably produced a fatal result within 20 hours. We can tone down the amount injected into the guinea-pigs so as not to produce a fatal result. The animal becomes ill, has a tumour at the seat of inoculation, the tumour ulcerates, and the animal ultimately recovers. We have had a series of animals and tried to protect them by sub-fatal doses, but we always found that they became much more susceptible to a second infection when they have once passed through the disease.

27,352. Have you inoculated animals with this micro-organism, and have you tested the effect of these animals' sera upon other animals?—Yes, we have done that also.

27,353. And you also found that you got prejudicial results?—Yes.

27,354. So that you think it is possible that the "anti-plague" serum might do harm as well as good?—I should not like to say that, because I should not like to generalize from one instance.

27,355. With regard to vaccination against plague, you have done some experiments—you have inoculated animals by living cultures?—Yes.

27,356. And you find that they do not thereby become noticeably less susceptible to plague?—Slightly less susceptible; after several inoculations with sub-fatal doses they still re-acted. They still re-acted on a fresh inoculation by showing the characteristic tumour and becoming ill.

27,357. Do you know how long this partial immunity lasts?—No, but there is only very slight immunity conferred after several inoculations; the animals are still susceptible.

27,358. Do you find you get better results by using living cultures than by using dead cultures?—I made a large number of experiments with both, particularly with sterilized cultures, and the sterilized cultures certainly have not given those results which one might have expected from similar experiments with other microbes, *e.g.*, typhoid and cholera.

27,359. How did you sterilize those cultures?—By heat—60° to 70° C. for five minutes, 60° to 63° for ten minutes is quite sufficient, but in order to make sure we generally used 62° to 65° for ten minutes or 70° C. for ten minutes.

27,360. Have you determined whether there is a diffusible toxine produced by the plague bacillus?—No, I have not.

27,361. Have you found that the dead bacteria are very toxic?—Apparently not. Large doses injected subcutaneously or intraperitoneally produced no disease.

27,362. You did not get a necrosis of the skin afterwards?—No.

27,363. In the case of animals which have been partially protected against plague, are the *post-mortem* appearances which are found when they succumb to plague in any way different from the *post-mortem* appearances which are found in animals which die rapidly from plague without offering any resistance?—Apparently not; when they die they have the same kind of lesions, that is to say, the spleen is enlarged and full of bacilli, the lung may be affected, and may have necrotic patches; the inguinal tumour at the seat of inoculation shows exactly the same characteristics. I mention here one experiment where an animal, after the fourth inoculation, developed a tumour which suppurated and which contained a great many other organisms besides the plague bacilli, so that these animals do not seem to have offered the same symptoms as an animal which is inoculated for the first time. On page 295 of my Report, I say:—"On the "9th day, the general condition of the animal remain-"ing normal, the tumour, which was still very large, "was examined, and found to be filled with fluctuating "contents: the skin above it, however, was unbroken." The animal had evidently some immunity conferred upon it.

27,364. Have you any experiments to show whether animals can be infected with plague by putting plague bacilli on their mucous membranes?—No, I have not.

27,365. (*The President.*) Have you ever fed animals with virus?—I do not think we have done any systematic experiments in that direction.

27,366. You have nothing to show whether the admission of the virus into the intestinal canal is followed by plague symptoms or not?—No; I could not say anything about that. The only thing I mention here is that animals have died from plague, having the proper bacilli in their alimentary canals. I have not made any systematic experiments by feeding fresh animals with these contents, only by inoculating animals.

27,367. In the alimentary canal were they restricted to the small intestine?—Yes.

27,368. Not in the stomach or higher up?—No. The small intestine was congested and generally distended by mucus.

27,369. These were cases in which the virus had been introduced by the skin?—Yes.

27,370. You think the serum of animals which have recovered from plague is destitute of any immunizing quality?—The serum of guinea-pigs which have been repeatedly infected with sub-fatal doses has certainly very little protective power with other guinea-pigs; that is all I can say. I could not go one step further. After these experiments, which I made on these guinea-pigs myself, I should be the last person to apply them to the human subject. I should like to state that very emphatically. Whatever is to be applied to the human subject has to be found out in the human subject. Whatever I found out on the guinea-pig applies to the guinea-pig. I should like to say that it applied to the guinea-pig only.

27,371. Have you tested the bactericidal power of the serum obtained from an animal which has recovered?—I have made several experiments, but the result was practically nil. One-tenth of ½ c.c. of the serum of an animal which had been injected several times previously with plague culture, and which has recovered from these repeated injections, has very little protective power or germicidal power for another animal.

27,372. Have you made any experiments upon the anti-toxine as distinguished from the bactericidal power?—No, I have not.

27,373. I think I heard you say a moment ago that animals may have had even four attacks of plague and yet are still susceptible to fresh inoculation?—Yes, they re-act; that is to say, they show the tumour, the bacilli develop there, and the animals become ill generally. In fact, if you use a sufficiently large dose they may succumb.

27,374. That is a condition which applies to all immunizations, is it not?—Yes.

27,375. There is no such thing as complete immunity?—No.

27,376. Are the doses necessary to produce the initial re-action required to be increased in order to produce the same re-action subsequently?—Yes.

27,377. Have you made any experiments as to the influence of various external conditions upon the vitality of the bacillus?—Only heat, no other.

27,378. What are the results of your experiments on the effects of temperature?—The temperature, I think, was 62°—upwards of 62° for five minutes—but to make quite sure we heated up to 65° or 70°.

27,379. Sixty-two degrees is sufficient to kill the bacilli?—Yes, 62° or 63° C. for 5-10 minutes.

27,380. Have you made any experiments on the influence of sunlight on the vitality of the bacillus?—No.

27,381. Or of access of air?—I have made recently some experiments—and they will be published in the next Blue Book of the Local Government Board—with reference to the vitality of the plague bacilli in the dead body.

27,382. Can you give us some of the results of these experiments?—Yes. At 14 days they are still recoverable. I am giving you now the results which are still in the printer's hands. I should say that 17 or 19 days

was the extreme length in the guinea-pig. I am speaking of the guinea-pig. That is to say, I inoculate the guinea-pigs with living plague culture subcutaneously, and the animals die between 48 and 72 hours. One set of animals are put in a wooden coffin and another set in a tin coffin, and a third are buried in the earth wrapped up in cloth, and another set are wrapped up in cloth and buried direct in the sand. The coffins are also put in the earth. Then they are exhumed after a given time. After 14 days and 17 days the plague bacilli are still recoverable both from the subcutaneous tumour and the spleen, but after 21 days there are no more living plague bacilli to be recovered from the dead body. Speaking from memory, I am not quite sure that 21 days is not the limit, but certainly beyond 21 days they cannot be recovered. (Note by witness on correcting proof of his evidence:—On looking at my paper on the subject, I find that in no case were the plague bacilli recoverable 21 days after burial.)

27,383. What was the season of the year?—These experiments with the plague bacilli are one of a whole series of experiments with typhoid, cholera, tubercle, bacillus prodigiosus, and staphylococcus aureus. Amongst the series are also experiments with the plague bacillus. That was done between May of last year and March of this year. The experiments extended over a considerable time.

27,384. Therefore the living bacillus exists actively for a long time in the dead body?—17 days, but certainly not so long as the popular belief would have it. I must say I do not quite understand the experiments which have been published with reference to the survival of the plague bacillus in earth. I should like to see those things done again.

27,385. (*Prof. Wright.*) Whose experiments are you referring to?—Hankin, I think, has published such, and Yersin himself made some statements with regard to this matter.

27,386. (*The President.*) You have not made any experiments?—No; Hankin could not recover it from earth.

27,387. Have you made any experiments with any other animals?—Rabbits and guinea-pigs only.

27,388. You have not investigated fleas or bugs?—No.

27,389. (*Mr. Hewett.*) Did I understand that you put the plague bacillus on earth, and that you were not able to recover it?—I placed it in a dead body in earth. We have made in the laboratory a large number of experiments with reference to many of these organisms in earth—bacillus prodigiosus, cholera, and typhoid—and the results are very remarkable in this way, that it is extremely difficult to recover them. They are very marked organisms, easily recoverable if present. You know how much more marked typhoid or prodigiosus is than the plague bacillus.

27,390. This applies to non-sterilized earth?—Yes. They were put directly into certain areas of soil of different kinds, and in a few days, or a few weeks, it is a matter of extreme difficulty to recover them.

27,391. (*The President.*) You have not made any definite experiments yourself?—No.

27,392. (*Prof. Wright.*) You have not made any experiments on clothing to see how long the infective material would remain in clothing?—No.

27,393. Do you kind that the plague bacillus is soon killed by desiccation?—I have made a few experiments with the plague bacillus, and, being a non-sporing bacillus, if it is desiccated in a thin film it dies immediately, just like many other non-sporing bacilli. Of course, it entirely depends on the thickness of the film. If you have a thick layer or a large lump—a piece of spleen—for instance, the possibility is that the centre remains undried.

27,394. (*The President.*) Have you found the bacillus in the blood of animals?—Yes.

27,395. In all parts of the circulation?—We generally use the heart's blood, and then we make sections of the organs and find them also in the blood vessels there.

27,396. Have you found them in the living animal?—Yes, in the blood.

27,397. Have you had much difficulty in finding the bacillus in living animals?—In the early stages, before 48 hours, I do not think we have succeeded in obtaining the plague bacilli from the blood, but on the last day of the animals' existence there was not very much difficulty in demonstrating them in the blood of the general circulation. I am speaking of cultivation.

27,398. Have you found the bacilli in any animals which recovered?—No.

27,399. Only in those which died, and shortly before death?—Yes, in those which were really afflicted, that is, animals which had a tumour and were quiet.

27,400. What is the longest interval before death that you have found the bacillus?—If an animal is injected subcutaneously in the groin with plague bacilli, there is generally a swelling already after 24 hours, and in this tumour plague bacilli can be easily demonstrated in large numbers, but in the blood of the general circulation of such an animal plague bacilli have not been demonstrated before 48 hours are over.

27,401. Have you tried the effect of chemical disinfectants?—Yes, I have tried Izal and carbolic acid, 2 per cent. carbolic and 1 in 300 Izal, and in three minutes they both are capable of disinfecting completely.

27,402. Killing entirely?—Yes. It was the ordinary pure carbolic acid.

27,403. You kept them under observation for some considerable time?—Yes.

27,404. For how long?—The cultures were kept 10 days to a fortnight.

27,405. Will you describe the experiments with disinfectants?—We generally use pure cultures of the material—24-hour agar culture, grown at 37° C. in order to ensure having active microbes. A particle of it is taken off and put in the disinfecting solution, which had been put previously into a sterile test-tube; a particle of the growth is put in and well shaken up so as to distribute it uniformly. It generally distributes very rapidly. It is then kept in this condition for five minutes; after this a considerable amount of it is taken out, two or three loops—which would, if the solution were water or salt, yield an innumerable number of colonies—and with it nutritive media (agar or broth, or both) are infected. These are then put into the incubator at 37° C., and the result watched. If only a few colonies come up, we should say that a great many of the microbes had succumbed, but that some few had survived the action of the disinfectants; but if no colonies at all come up, then we say there were no living microbes left. If you make such an experiment that is to have scientific value, you have to use definite pure cultures and not merely material which contains these microbes. The only disinfectant experiments on the plague bacilli that I made were with carbolic acid 2 per cent. and Izal 1 in 300.

27,406. In your experiments on the two species of animal you found that the susceptibility of a rabbit was different from that of a guinea-pig?—Yes, a rabbit is more susceptible than a guinea-pig.

27,407. How did you dose them?—We gave them a good dose so as to ensure a positive result.

27,408. You mean you gave the rabbit the same dose as you gave the guinea-pig?—We give them always a much bigger dose than would be required to kill them.

27,409. Then you do not know what the amount which is required to kill them is?—No, only the duration of the disease. I could not put my hand on the rabbit experiments, but I could look them up in my note-book. I know, in order to ensure a fatal result, we always gave them a dose which was larger than was exactly the fatal dose.

27,410. You made no attempt to determine the smallest quantity?—No; we do not know what is the highest or the lowest quantity.

27,411. How did you come to any conclusion as to the difference of susceptibility? By weight?—Yes. We weighed the animals and accordingly gave the amount of dose.

27,412. What amount of dose?—$\frac{1}{10}$th, $\frac{1}{15}$th, or $\frac{1}{20}$th of a culture.

27,413. And you varied that amount according to the weight?—Yes.

Dr. Klein, F.R.S.

20 May 1899.

27,414. And you found that the variation which held with the guinea-pig did not hold with the rabbits?—Yes.

27,415. (*Mr. Hewett.*) Can you give us any facts as to the case of plague alleged to have been landed at Plymouth from the *Golconda*?—On December 29th, 1898, I received four capillary tubes with blood taken from the finger of a patient landed at Plymouth from the *Golconda*. The material was brought to me by Dr. Bulstrode, Inspector to the Local Government Board, and was to be examined for the Medical Department of the Local Government Board, to which Department my report was sent early in January. Neither by microscopic examination, nor by culture, nor by experiment on animals, were any plague bacilli discovered in the above blood samples.

(Witness withdrew.)

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APPENDIX No. LV.

(*See* Question No. 17,798.)

NOMINAL ROLL
of INOCULATED and UNINOCULATED KHOJAS in BOMBAY, who died from PLAGUE and other causes from 20th April, 1898, to 21st December, 1898, compiled by MR. ISMAIL JAN MAHOMAD.

INOCULATED. DIED OF PLAGUE.

28.4.98. Karmally Lootafally, age 10 years, died of plague at hospital.

5.8.98. Nanjee Taya, age 22, died of plague at Moondagali. *Inoculated in* 1897.

12.8.98. Mahomed Varin, age 37, died of plague at Bhendibazar. *Was twice inoculated this year, and twice inoculated last year,* 1897.

28.9.98. Valli Mahomed Karim, age 12, died of plague at hospital, residing at Diva off Thana. *Once inoculated.*

INOCULATED. DIED OF DISEASES.

17.5.98. Motibai, wife of Kasam Jan Mahomed, age 20, died of delivery at Durga Street.

25.5.98. Loopli Jivan Soorditha's daughter Viroo, age 2 years, died of diarrhœa at Mazagaon.

30.5.98. ? Kasam Karmaly Soojis' wife Khairsabai, died of consumption at Khoja Street. *Twice inoculated.*

9.6.98. Jan Mahomed Visram, age 45, died of (?), Khoja Street; died at Hospital of Jamsetjee Jeejeebhoy. *Once inoculated.*

14.6.98. Jaffer Lakha, age 32, died of paralysis at Durga Street. *Once inoculated.*

15.6.98. ? Avalbai, wife of Remtala Mitha, age 30, died of consumption at Dougri. *Once inoculated.*

3.7.98. ? Jainab, daughter-in-law of Jagga Visram, age 20, died of consumption and delivery at Khoja Street. *Was inoculated.*

9.7.98. ? Sakina Meetha Rahimtula, age 11, died of consumption at Dongri Street. *Once inoculated in* 1897.

16.7.08. Pirbhai Devan, age 50, died of asthma at Duncan Road. *Was inoculated.*

23.7.98. ? Janbai, wife of Neuji Jiva, age 65, died of asthma at Dongri. *Was inoculated.*

28.7.98. Ali Mahomad Karsan Bava, age 2, died of fever and cold at Pala Bazar. *Once inoculated.*

5.8.98. Hoosen, son of Abduia Nensi, age 8 months, died of diarrhœa at Durga Muhalla.

7.8.98. ? Foolbai, wife of Hoosen Taya, age 56, died of brain fever at Moondagali.

7.8.98. Ranjee Bhanjee, age 54, died of asthma at Khojagali.

7.8.98. ? Issa Ibraham Pardhan, age 2½ years, died of consumption at Kharak.

7.8.98. Kasam Poonja's granddaughter, Sakina, age 1½ months, died of convulsions at Furniture Bazar.

14.8.98. Kara Kanji, age 35, died of (?) at Kandi Muhalla. *Once inoculated this year.*

18.8.98. ? Shubanali Kammoo Kurmali, age 24, died of consumption at Mazagaon H. A. compound yard. *Inoculated.*

20.8.98. ? Kamarbai, wife of Kasam Nathu Habocani, died of consumption at Pala Lane. *Once inoculated.*

23.8.98. Motibai, wife of Harji Nunji, age 18, died of (?) at Kandi Muhalla. *Twice inoculated.*

23.8.98. Hirbai, wife of Kanji Bhimji, age 56, died of brain fever at Kandi Muhalla *Inoculated.*

24.8.98. Aladina Bhahdina's wife Jaithbai, age 65, died of fever at Umarkhadi. *Once inoculated.*

3.9.98. Suntokbai, wife of Moona Nathu, died of (?) at Bhendibazar. *Inoculated twice.*

10.9.98. Nagindas Mathuradas, age 34, died of brain fever at Bhuleshwar. *Twice inoculated.*

12.9.98. Hassan Rahimtula, age 28, died of prolonged illness of fever at Dongri. *Twice inoculated.*

15.9.98. Siribai, daughter of Soomar Bharmal, age 9, died of other fever at Pala Lane. *Twice inoculated.*

16.9.98. ? Sonbai, wife of Kasam Manji, age 47, died of fever at Kharak. *Once inoculated.*

21.9.98. ? Ismail Rattansi, grandson Kasam Hassan, age 15, died of brain fever at Kandi Muhalla. *Twice inoculated.*

25.9.98. Dhanji Rooga, age 75, died of asthma at Kandi Muhalla. *Twice inoculated.*

29.9.98. Fatma, wife of Mahomed Nanjee, age 17, died of consumption. *Twice inoculated.*

14.10.98. ? Jaffer Lila Devji's daughter Fatma, age 10, died of fever at Kandi Muhalla. *Thrice inoculated.*

18.10.98. ? Daughter of Pundit Siv Dayal, Sakina, age 5 years, died of fever at Mazagaon at H. H. *Once inoculated.*

26.10.98. ? Sakina, daughter of Khanji Lalji, age 10, died of brain fever at Pala Bazar. *Once inoculated.*

4.11.98. Jaina, daughter of Mahomad Karim, age 5 years, died of diarrhœa at Dongri. *Twice inoculated.*

4.11.98. Jaina, daughter of Samsoodin Bhajin, age 4, died of diarrhœa at Dongri Bazar. *Once inoculated.*

6.11.98. ? Vally Jamal, age 32, died of fever at Durga Muhalla. *Once inoculated.*

8.11.98. ? Kajbai, wife of Hirji Fakir, age 25, died of delivery at Durga Street. *Twice inoculated.*

15.11.98. ? Karim Nathu Shivji's wife, Mariambai, age 25, died of consumption at Durga Muhalla. *Once inoculated.*

18.11.98. Mariambai, wife of Jan Mahomed Gangji, died of (?) at Moonda Gali. *Once inoculated.*

18.11.98. Khatza, daughter of Rahimtoola Khimji, age 22, died of asthma at Palki Muhalla. *Twice inoculated.*

22.11.98. ? Sakinabai, wife of Mahomed Alloo, age 24 years, died of delivery at Durga Street. *Once inoculated.*

23.11.98. Sonbai, mother of Goolam Hoosen Moulji, age 72 years, died of asthma at Durga Street. *Once inoculated.*

27.11.98. Sakinabai, wife of Allarakhia Gangji, age 25, died of consumption at Durga Street. *Once inoculated.*

28.11.98. Sakinabai, wife of Canji Lalji, age 27, died of Pala Lane. *Once inoculated.*

29.11.98. Minbai, wife of Hassan Megji, age 45 died of consumption at Furniture Bazar. *Once inoculated.*

NON-INOCULATED. DIED OF PLAGUE.

28.4.98. Jaffer Poonja, age 50, died of plague at hospital. Had come from Bandra.

1.5.98. Goolam Hoosen Alarakhia, age 20, died of plague at hospital. Had come from Bandra.

12.5.98. Manji Khimji, age 30, died of plague at hospital. From Bandra.

28.8.98. Navroj Ladha Sachoo, age 22, died of plague at hospital. Resident of Mandvi. Plague caught at Bombay.

31.5.98. Mahomad Rahim Manji, age 16, died of plague at Dongri Street.

2.6.98. Ladha Lachoo's wife, age 50, died of plague at hospital. Residence of Manorj.

24.7.98. Kasam Mahomad Hassan, age 14, died of plague at Hospital. Came from Danda with plague.

9.8.98. Sherbanoo, granddaughter of Haji Lalji age 12, died of plague at Khoja Street.

19.8.98. Remtala Sajan, age 56, died of plague at Durga Street.

19.8.98. Kesarbai, wife of Goolansan Abbhai, age 35, died of plague at Durga Street.

20.8.98. Roopsy Virjee, age 38, died of plague at Pala Lane.

21.8.98. Lonbai, wife of Mahomed Premji, age 55, died of plague at Pala Lane.

23.8.98. Hoosen Jaffer Ibrahim, age 23, died of plague at Kharak.

25.8.98. Jaffer Mariambai, wife of Hoosen, age 15, died of plague at Kharak.

27.8.98. Cooverbai, wife of Khan Mahomed Simji, age 25, died of plague at Kharak.

28.8.98. Kasam Ramji Boga, age 18, died of plague at Durga Muhalla.

1.9.98. Alladin Hassan's mother, age 60, died of plague at Dongri.

1.9.98. Jamabai, wife of Haji Nathoo, age 40, died of plague at hospital.

2.9.98. Pirbai Karmali, age 23, died of plague at Pala Lane.

4.9.98. Babool Ramji Canji, age 18, died of plague at Pala Bazar.

4.9.98. Mithibai, wife of Jooma Kara, age 30, died of plague at Dongri.

6.9.98. Ibrahim Shariff, age 64, died of plague at Durga Street.

7.9.98. Alli Ghiga, age 50, died of plague at Kharak.

7.9.98. Kasam Nathoo, Manji, age 29, died of plague at Furniture Bazar.

7.9.98. Virji Khimji, age 65, died of plague at Kharak.

9.9.98. Virji Khimji's daughter Sakina, age 15, died of plague at Kharak.

10.9.98. Abdoola Karim, age 40, died of plague at Dongri.

12.9.98. Lalbai, wife of Hassan Karim, age 40, died of plague at Dongri Street.

12.9.98. Manji Dhanji, age 19, died of plague at Pala Bazar.

13.9.98. Meheralli Rattansi, age 16, died of plague at Kharak.

22.9.98. Karmali Hassan Megji, age 12, died of plague at Dongri.

25.9.98. Mahomed Hasan Shivji, age 23, died of plague at Durga Muhalla.

24.9.98. Jaffer Ibrahim, age 38, died of plague at Durga Muhalla.

28.9.98. Ramjanalli Karmali, age 19, died of plague in hospital at Dongri.

28.9.98. Mooraj Alloo, age 25, died of plague.

28.9.98. Karmali Rahim, age 12, died of plague at hospital.

28.9.98. Daughter of Bundealli Allarakhia, age 10, died of plague at Durga Street.

29.9.98. Moosa Kasam Karim, age 39, died of plague at Dongri.

3.10.98. Bhanji Hasanaly Sowcar, age 18, died of plague at Pala Bazar.

22.10.98. Ismail Jaffer Nathoo, age 28, died of plague at Dongri.

12.11.98. Ali Ibrahim Mahomad, age 20, died of plague at Dongri.

17.11.98. Jan Mahomed Ramji, died of plague at Bhendibazar (died at hospital.)

15.12.98. Shivji Nanji Visram, age 25, died of plague at Pala Lane.

NON-INOCULATED. DIED OF DISEASES.

23.4.98. Fatma, wife of Abdala Ismail, age 28, died of consumption at Durga Muhalla.

24.4.98. Alibhai Hassan Khimji, age 20, died of consumption at Kandi Muhalla.

25.4.98. Aloo Meraly's son, age six months, died of fever at Mazagaon.

25.4.98. Lale Soonar's daughter, age 4 months, died of convulsion at Dongri Street.

26.4.98. Virbai, wife of Virji Haboo, age 70, died of consumption and sore throat at Pala Gali.

27.4.98. Minbai, wife of Ravji Sanga, age 55, died of heart disease at Durga Muhalla.

27.4.98. Wala Devji's son, age 1½ years, died of fever at Kharak.

— Dhala Lachoo's son, age 1 month, died of convulsion at Durga Muhalla.

28.4.98. Piarally Abdala's son, age 1½ years, died of consumption at Kharak.

28.4.98. Mitha Premji's brother's daughter, age 1 year, died of convulsion at Durga Street.

29.4.98. Mirza Ali Khan Mahomad, age 30, died of consumption at Durga Muhalla.

29.4.98. Ismal Meraly's son, age 4 months, died of convulsion at Durga Street.

30.4.98. Goolam Hoosen Mahomad Versi, age 4 months, died of fever at Dongri.

1.5.98. Mahomadbhoy Ravji, age 40, died of heart disease at Khoja Molla.

3.5.98. Kasam Jan Mahomad's daughter, age 1 month, died of convulsion at Durga Street.

4.5.98. Fazal Noor Mahomad's grand-daughter Mariam, age 4 months, died of convulsion at Kharak.

4.5.98. P Sherally Pirbhais' son Jainatabdia, age 3 years, died of convulsion at Durga Muhalla.

— Alibhai Karmally Soorji, age 46, died of consumption at Khoja Muhalla.

5.5.98. Sonbai, wife of Walji Ramji, age 60, died of consumption at Durga Muhalla.

— Khatijabai, daughter of Ladha Remtala, age about 6 months, died of cough at Dongri.

7.5.98. Lootafally Karmally's daughter, age about a month, died of diarrhœa at Durga Street.

7.5.98. Karmally Fazal, age 98, died of asthma at Israel Street.

10.5.98. Kasam Nanji, age 45, died of consumption at Durga Muhalla.

10.5.98. Suleman Rahim's wife, age 35, died of consumption at Durgadevi.

11.5.98. Abdala Ladha Chatoo's daughter Sakina, age 12 months, died of convulsion at Pala Lane.

12.5.98. Motibai Kanji, age 22, died of consumption at Kandi Muhalla.

13.5.98. ? Goolam Hoosen Ebram Walji, age 1½ years, died of fever at Mazagaon.

14.5.98. Aladin Kasam Khimji, age 40, died of liver complaint at Dongri.

14.5.98. Karim Panchan's wife Aval, age 32, died of consumption at Mazagaon. *Once inoculated.*

14.5.98. Chatoo Visram, age 70, died of consumption at Durga Street.

14.5.98. Abdala Fazal, age 15, died of fever at Durga Street.

15.5.98. Mahomad Bhagbaria, age 35, died of paralysis at Palagali.

16.5.98. Fatma, daughter of Ragooji Jamal, died of convulsion at Durga Street, age 72.

16.5.98. Dost Mahomad Hassan Noor Mahomad, age 5, died of fever at Moonda Gali.

18.5.98. Sakinabai, grand-daughter of Jessa Premji, age 14, died of brain fever at Durga Street.

18.5.98. Sakina, wife of Fazal Noor Mahomad, age 24, died of delivery at Kharak.

20.5.98. Mother of Noor Mahomad Khatri, age 75, died of fever at Darga Muhalla.

23.5.98. Aba Moloo, age 54, died of asthma at Durga Street.

23.5.98. Fazal Ladha Lalji, age 40, kidney disease at Khoja Muhalla.

24.5.98. Lalbai, wife of Ibram Sheriff, age 62, died of consumption at Durga Street.

24.5.98. Ibram, son of Remtula Koorji, age 9, died of asthma at Duncan Road.

25.5.98. Alarakhia Thaver, age 54, died of consumption at Kharak.

25.5.98. Mahomad Vally Jessa, age 2 years, died of convulsion at Durga Street.

26.5.98. Abdala grandson of Haji Sivji, age 12 months, died of convulsion at Durga Street.

26.5.98. Alarakhia Kanji's grandson, age 6 months, died of convulsion at Durga Street.

27.5.98. Hoosen Ali Lutafally of Kamria Mahomad Chotti, age 26 died of consumption at Dongri Street.

29.8.98. Wife of Premji Gangji Soolbai, age 60, died of diarrhœa at Pala Gali.

31.5.98. Grand-daughter of Khaki Radamsi, age 2 years, died of convulsion at Kharak.

3.6.98. Daughter of Fatehally Thaver, Bai Sherbanoo, age 12, died of consumption at Furniture Bazar.

3.6.98. Hoosen Alarakhia Jivray, age 7 months, died of convulsion at Khoja Street.

4.6.98. Bacheebai, daughter of Ismal Suji, age 4 months, died of diarrhœa at Dongri Street.

4.6.98. Jafferaly Aladin Kassam, age 2½ months, died of convulsion at Dongri Street.

6.6.98. Fazal Ibram's wife Jainab, age 39, died of fever at Khoja Street.

7.6.98. Fatma, wife, daughter-in-law of Premji Paroo, age 15, died of consumption at Khoja Street.

7.6.98. Nanbai, wife of Soomar Rajpar, age 60, died of diarrhœa at Dongri.

10.6.98. Bachoo, grandson of Mahomed Karim, age 8 months, died of convulsion at Byculla.

11.6.98. Kasam Hassan Mawjee, age 1 year, died of fever and convulsion at Umarkhadi.

12.6.98. Lowjee Canjee, age 22, died of ? at Kolaba.

14.6.98. Abdul Husen Mahomed Ibrahim Bhuloo age 1 year, died of convulsion at Khoja Street.

15.6.98. Mariam, daughter of Nowroj Lakha, age 7 months, died of convulsion at Dongri Street.

18.6.98. Jaffer Ismail Mahomed, age 8 months, died of fever at Durga Street.

18.6.98. Goolamalli Hoosen Ladak, age 5 months, died of convulsion at Dongri Street.

20.6.98. ? Dhanbai, daughter of Mahomed Jootha, age 12, died of consumption at Kandi Muhalla.

20.6.98. ? Moloo Mahomed Ladak, age 30, died of consumption at Kharak.

23.6.98. ? Fatma, wife of Lale Mahomed Ibrahim, age 28, died of consumption at Khoja Street.

23.6.98. ? Sakina, daughter of Lowji Daya, age 12, died of consumption at Dongri.

24.6.98. Nanjee Valji's son, age 8 months, died of fever at Umarkhadi.

24.6.98. Sheriff Dossa's daughter, age 3 months, died of convulsion at Kandi Muhalla.

27.6.98. Sherbano Rahim Assar, age 8 years, died of diarrhœa at Dongri Bazar.

28.6.98. ? Nanbai, wife of Jiva Soomar, age 48, died of consumption at Durga Street.

28.6.98. Joosab Karmali Haji Boga, age 10 months, died of convulsion at Khoja Street.

30.6.98. ? Daughter of Rajabally Jan Mahomed, age one week, died of ? at Kandi Muhalla.

3.7.98. Ahmed Gangji, age 25, died of consumption at Old Nagpada.

3.7.98. ? Fatma, grand-daughter-in-law of Simji, age 25, died of consumption at Market.

4.7.98. Khakoo Peerbhoy, age 65, died of liver complaint at Khoja Street.

6.7.98. ? Mahomed Khulphan's wife Walbai, age, age 28, died of consumption.

6.7.98. Mahomed Lowjee Visram's grandson, age 4 months, died of ? at Dongri.

6.7.98. ? Grand-daughter of Khakhoo Laljee, age 3 years, died of convulsion at Durga Street.

9.7.98. ? Rhematbai, wife of Dhanji Jairaj, age 60, died of consumption at Phosabazar.

10.7.98. Daughter of Mahomed Jaitha, age 4 months, died of convulsion at Kandi Muhalla.

12.7.98. Goolam Hoosen Dharamsi Damji, age 15, died of ? at Pala Lane.

12.7.98. Bachoo Dhala Jivraj, age 15 days, died of convulsion at Kharak.

13.7.98. Jamal Jiva, age 45, died of ? at Dongri Street.

13.7.98. ? Koorbai, mother of Jan Mahomad Magji, age 85, died of fever at Khoja Street.

13.7.98. ? Fatma, grand-daughter-in-law of Bana Lila, age 24, died of fever at Kharak.

13.7.98. Bachi Alarakhia Virjee, age 2 months, died of purge at Byculla.

13.7.98. ? Mahomed Rowjee Aloo, age 2½ years, died of asthma at Durga Street.

14.7.98. Serenbai, daughter of Ladha Thaver, age 12, died of ? at Pala Lane.

15.7.98. ? Mongibai, wife of Karmali Jamal, age 16, died of consumption at Durga Street.

16.7.98. ? Haji Ramjanalli, age 14 months, died of fever at Bhendibazar.

16.7.98. Bachoo Fazal Alidina, age 6 months, died of convulsion at Umarkhadi.

18.7.98. Janiab, grand-daughter of Nanji Bhanji, age 6 months, died of fever at Dongri.

19.7.98. ? Fatma, daughter-in-law of Ladak Rahim, age 17, died of consumption at Khoja Street.

19.7.98. Mahomad Khimji's son, age 23 days, died of diarrhœa at Pala Bazar.

20.7.98. Daughter of Gangji Walji, age 3 months, died of convulsion at Dongri.

21.7.98. ? Nanbai, mother of Hassanally Nanji, age 45, died of asthma at Kharak.

25.7.98. ? Rambai, wife of Hoosenally Nanji, age 16, died of delivery at Kharak.

26.7.98. Manbai, wife of Remtula Kadar, age 60, died of sore and asthma at Durga Street.

26.7.98. ? Sonbai, wife of Haji Visram, age 30, died of consumption at Khoja Street.

26.7.98. ? Fazal Khaki, age 5, died of asthma at Kharak.

29.7.98. Sakar, daughter of Hoosen Mamuk, age 1 year, died of diarrhœa at Durgamolla.

27.7.98. ? Fazal Noormahomed Jan Mahomed, age 21, died of brain fever at Pala Lane.

27.7.98. ? Fatma, daughter of Kanji Jivraj, age 10, died of asthma at Kharak.

1.8.98. ? Nanji Khakoo, age 65, died of fever at Dongri.

2.8.98. ? Nasar Manji's daughter, age 2 years, died of convulsion at Durga Muhalla.

3.8.88. ? Ismail Meraly's wife, Jainab, age 21, died of delivery and consumption at Durga Street.

3.8.98. Moosa Hassan, age 62, died of prolonged illness of asthma and consumption at Dongri.

3.8.98. Ahmadally Goolamally Goolamhusen, age 1 year, died of asthma at Dongri.

3.8.98. Virji Goolamsen's daughter, age 6 months, died of convulsion at Dongri.

3.8.98. Sakina, daughter of Ladha Daraj, age 12 months, died of fever at Kharak.

3.8.98. Sakina, daughter of Daya Kara, age 1 year, at Dadar.

4.8.98. Nensi Nathoo's daughter, age 20 days, died of diarrhœa at Kharak.

8.8.98. Visram Ooka's son, Jooma, age 2½ years, died of convulsion at Kandi Muhalla. *Once inoculated.*

8.8.98. Dhala Vanya's wife, age 42, died of Nasove at Dongri.

9.8.98. Moolji Ravji, age 70, died of fever at Furniture Bazar.

11.8.98. Kasam Bhimji, age 56, died of (?) at Dongri.

11.8.98. ? Dewji Jaitha, age 65, died of fever at Kharak.

13.8.93. ? Kasam Bhimji's grandson, age 1½ years, died of ? Durga.

13.8 98. ? Jooma Merali's son, age 5 years, died of fever at Durga Muhalla.

16.8.98. ? Sonbai, wife of Versi Merali, age 60 years, died of fever and asthma at Durga Muhalla.

21.8.98. ? Hasan Hemraj, age 30, died of ? at Jacob Circle.

22.8.98. ? Sajan Goolam Hoosen's mother, Rataribai, age 70, died of asthma at Pala Lane.

23.8.98. Hasan Alloo Ibrahim, age 37, died of consumption at Dongri.

24.8.98. Hasan Meheralli's son, age , died at Mazagaon.

24.8.98. Ismail Rhemoo's son, age 8, died at Grant Road.

24.8.98. ? Hoosen Moolji Rahim, age 14 months, died of asthma at Durga Street.

24.8.98. Sonbai Karim Nanjee's grand-daughter-in-law, age 16, died of fever at Kharak.

27.8.98. ? Jainab, daughter of Noormahomed Valji, age 8, died of convulsion at Furniture Bazar.

28.8.98. Manick Virji, age 50, died of diarrhœa at Furniture Bazar.

30.8.98. Jooma Dharamsi, age 40, died of sore at Durga Muhalla.

31.8.98. ? Sakina Mahomed Anund, age 2 years, died of fever at Durga Muhalla.

31.8.98. Bachoo, son of Bakhsi Shariff, age 1¼ months, died of diarrhœa at Kharak.

1.9.98. ? Kaloo, father of Kala, age 75, died of consumption at Jaamat Khana,

1.9.98. Wife of Jan Mahomed Versi, age 25, died of consumption at Kharak.

1.9.98. Mariambai, wife of Kasam Goolam Hoosen Dinani, age 34, died of delivery at Dongri.

4.9.98. Sakina Kasam Somji, age 1½ years, died of convulsion at Kharak.

5.9.98. Koolsan Jairaj Lakhamsi, age 5 months, died of indigestion at Market.

6.9.98. ? Rajabally Sharriff Moloo, age 23, died of consumption at Kharak.

8.9.98. Pirbai Versi, age 42, died of consumption at Durga Street.

9.9.98. Hoosen Khimji Goolam Hoosen, age 35, died of consumption at Dongri (residing at Vasur).

9.9.98. ? Meherali Karim, age 56, died of asthma at Dongri.

9.9.98. ? Fatma Kasam Thaver, age 3 years, died of consumption at Kandi Muhalla.

10.9.98. Gangbai, wife of Hassan Bhaloo, age 64 years, died of (?) at Khoja Street.

11.9.98. Issa Kasam Bhimji, age 14 years, died of consumption at Dongri.

11.9.98. ? Virji Kala, age 65, died of consumption at Kandi Muhalla.

13.9.98. Siri, grand-daughter of Pira Bana, age 10 months, died of diarrhœa at Kharak.

15.9.98. Sathbai, daughter of Meheralli Dewsi, age 12, died of consumption at Old Nagpada.

18.9.98. ? Jainab, wife of Somji Lalji, age 34 years, died of consumption at Pala Lane.

21.9.93. Alli Jairaj, age 52, died of fall from accident on board of steamer, residing at Kharak.

19.9.98. ? Kara Koreji, age 80, died of asthma at Byculla.

25.9.98. Ramji Dada Danji, age 3, died of diarrhœa at Palki Muhalla.

25.9.98. Sakina, grand-daughter of Rahimtula Dewji, age 3 years, died of ? at Lalwadi.

25.9.98. ? Fatma, daughter of Pardhan Haji, age 16, died of consumption at Dongri.

28.9.98. ? Sakina, daughter of Alla Jivraj, age 14, died of consumption at Umarkhadi.

29.9.98. Fatma, daughter of Sachoo Valli, age 11, died of consumption at Kharak.

1.10.98. Fatma, wife of Ali Lakhamsi, age 32, died of delivery at Furniture Bazar.

1.10.98. Sakina, daughter of Jan Mahomad Harji age 8, died of diarrhœa at Pala Lane.

5.10.98. ? Gagan Nenji, age 72, died of asthma at Durga Street.

5.10.98. ? Lalji, age 2 years, died of convulsion at Durga Street.

6.10.98. ? Jainabai, daughter of Goolamhusen Mooraj, age 14, died of asthma at Dongri.

6.10.98. Bagbai, wife of Meraly Premji Jivraj, age 25, died of delivery at Kharak.

6.10.98. Sivinbai, daughter of Magji Taija, age 10 years, died of fever at Kharak.

6.10.98. Noor Mahomad Chagle, age 60, died of paralysis at Kharak.

7.10.98. Ali Rahim, age 48, died of consumption at Kharak.

7.10.98. Nathibai, age 65, died of fall from window at Dongri.

12.10.98. Hassan Goolam Hoosani Mitha, age 18, died of ? at Durga Street.

13.10.98. Hoosani Sachoo Habib, age 1 year, died of fever at Kharak.

14.10.98. Megbai, wife of Bhanji Bhanji, age 18, died of asthma at Durga Street.

17.10.98. Abdoola Mahomad Khoja, age 28, died of diarrhœa at Durga Street.

19.10.98. ?Sakina, daughter of Khimji Sajan, age 11, died of fever at Kharak.

19.10.98. ?Remat, wife of Mahomad Bhanji, age 24, died of consumption at Darga Mohola.

19.10.98. ?Remat, wife of Nanji Kalian, age 42, died of ? at Durga Street.

20.10.98. Nathoo Karnu's son, age 2, died of fever at Palagali.

21.10.98. ?Suleman Pirbhai Sadoo, age 25, died of fever at Dongri.

21.10.98. Kachra Rhemu Premji, age 2½ years, died of fever at Furniture Bazar.

22.10.98. ?Nanbai, wife of Hassan Jaffer, age 17, died of delivery at Dongri Street.

26.10.98. Jaina, daughter of Kara Ratansy, age 6 months, died of fever at Durga Street.

26.10.98. Sakina, daughter of Walji Punju, age 1½, died of consumption at Kandi Muhalla.

28.10.98. ?Fatma, wife of Fazal Rhemtala Walji, age 24, died of fever at Durga Muhalla.

29.10.98. ?Jairaj Ladha, age 65, died of brain fever and asthma at Kharak.

29.10.98. Kulsam, daughter of Fazal Alibhoy, age 6 months, died of consumption at Dongri, residing at Koorla.

30.10.98. Satbai, wife of Jaffer Soomar, age 25, died of suicide by drowning herself in a fountain, residing at Durga Muhalla.

1.11.98. Fatma, daughter of Gella Bhaiji, age 2 years, died of fever at Dongri.

5.11.98. Goolamally Mahomad Mirza Bhaloo, age 1¼ years died of diarrhœa at Khoja Muhalla.

8.11.98. Kulsam, grand-daughter of Suji Hassan, age 3 months, died of convulsion at Furniture Bazar.

9.11.98. ? Merally Hassan Kallian, age 23, died of consumption at Umarkhadi.

9.11.98. Pir bhai Noor Mahomad Virji of Mahim, age 35, died of liver at Falkland Road.

13.11.98. ? Goolamhusen Merally, age 12 months, died of fever at Dongri.

14.11.98. ?Sakinabai, daughter of Anund Moorji, 2¼ years, died of fever at Mazagaon.

14.11.98. ?Ramjan Goolam Hoosen Mahomed, age 35, died of fever at Durga Street.

16.11.98. ?Janbai, wife of Shivji Manek, age 73, died of asthma at Khoja Muhalla.

19.11.98. ?Rattanbai, mother of Canji Coorji, age 65, died of asthma at Kharak.

21.11.98. Nagji Valji's son, Ahmed, age 6 months, died of fever at Umarkhadi.

21.11.98. ?Virbai, wife of Nanji Moolji, age 58, died of consumption at Durga Street.

22.11.98. Hassam Nathoo Moolji's son, Bachoo, age 7 months, died of fever at Palagali.

23.11.98. Ahmeed Allimahomed Shariff, age 17, died of convulsions at Market.

27.11.98. Ahmedalli, son of Goolam Hoosen Ismail, age 9 months, died of convulsion at Durga Street.

28.11.98. Ladha Munji, age 25, died of wound on foot at J. J. Hospital (he came from Mahim).

29.11.98. Dawood Janmahomed's son, Suleman, age 1½ years, died of fever at Kharak.

30.11.98. Minbai, wife of Juvan Munji, age 85, died of asthma at Dongri.

30.11.98. Hoosen Nensi Kheraj's son, Suleman, age 1½ years, died of fever at Kharak.

3.12.98. Ladak Megji's son, Aboo Mahomed, age 5 months, died of vomit and diarrhœa at Kharak.

6.12.98. Bai Lalbai, wife of Somar Nensi, age 65, died of fever and diarrhœa at Furniture Bazar.

8.12.98. Sherally, son of Valji Soomar, age 4 months, died of fever and diarrhœa at Kandi Muhalla.

8.12.98. Jivraj, son of Alli Mahomed Virji, age 2 years, died of fever at Khoja Muhalla.

8.12.98. A maid servant of Bibi Gohar, died and buried in our Durga.

12.12.98. ?Ahmed Lakha, age 65 years, died of asthma at Durga Street.

12.12.98. Bibi Gohar, age 75, died of asthma at His Highness Aga Khan Mazar, *not* buried in our Durga.

13.12.98. ?Meralli Mahomed Gangji, age 30 years, died of asthma at Durga Street.

15.12.98. Jan Mahomed Gangji's daughter, age 1 month, died of convulsions at Kharak.

16.12.98. Visrani Moolji's daughter, age 1 day, died of ? at Dongri.

17.12.98. Alarakhia Nathoo, age 62, died of asthma at Mahalakshmi (his city address, Pala Bazar).

18.12.98. ?Sonbai, wife of Haji Jiva, age 40 years, died of consumption at Furniture Bazar.

18.12.98. Dost Mahomed Pirbhai's son, age 22 days, died of convulsions at Dongri Street.

20.12.98. ?Sonbai, wife of Fazal Virji, age 18 years, died of delivery at Durga Muhalla.

20.12.98. ?Visram Allana, age 62 years, died of fever at Palki Muhalla.

20.12.98. Daughter of Fazal Virji was delivered, *still-born*.

21.12.98. Jooma Shamji's son, Ranjoo, age 14 months, died of fever at Kandi Muhalla.

21.12.98. Bachooli, daughter of Fazal Dharamsi Poonja, age 3 years, died of cold at Khoja Street.

APPENDIX No. LV. (i.).

REPORT

BY

DR. KHAJA ABDULLA,

REGARDING

THE KHOJA HOSPITAL, BOMBAY,

WITH

A LIST OF INOCULATED PERSONS TREATED IN IT.

I.

From the SECRETARY TO THE INDIAN PLAGUE COMMISSION to Dr. KHAJA ABDULLA, Khoja Hospital, Bombay, dated India Office, 28th July, 1899.

SIR,

I AM directed to invite your attention to my letter, No. 969, dated March 27, 1899, to which no reply has as yet been received. The Commissioners will be obliged if you will send as early as possible, and if possible by next mail, to me at the India Office, London, the particulars you were asked to supply regarding anti-plague inoculation among the Khojas, viz.:—

(1) A list of those treated at the Khoja Hospital, showing the names of the inoculated Khojas who have had plague, giving the number and date of the inoculation of each person, the date of attack and admission, and the result of the disease, whether fatal or not; and

(2) The total number of uninoculated Khojas who have had plague, together with the mortality among them.

II.

To the SECRETARY, INDIAN PLAGUE COMMISSION, India Office, London.

SIR, Bombay, 18th August, 1899.

I HAVE the honour to inform you that on the 15th of April last, I handed over to the late Khan Bahadur Mahomedbhoy Ebrahim, the founder of the Khoja Plague Hospital, as usual, to be sent to you, my report, together with the statistics about the inoculated and non-inoculated patients treated in the hospital. On the death of the founder of the hospital it was discovered that the said report was not sent to you, and the lawyers of the representatives of the deceased, at my request, returned to me the same on the 14th instant, a copy of which I beg to forward to you.

I have, &c.
KHAJA ABDULLA.

III.

To the SECRETARY, INDIAN PLAGUE COMMISSION.

Mahomedbhoy Ebrahim Plague Hospital for Khojas.
Bombay, 15th April, 1899.

SIR,

IN reply to your letter dated 27th March 1899, I have the honour to submit the particulars about the patients treated in this hospital, both inoculated and non-inoculated.

Since the opening of the hospital on the 26th of April 1897 to 5th April 1899, 347 plague patients were treated in the hospital, out of which 62 cases were inoculated. Some of the patients produced certificates of inoculation, others did not produce any certificate, but the relatives and guardians of the patients declared the information of the fact of their being inoculated. The list herewith annexed gives all particulars in our possession regarding cases of inoculated persons. Of the 62 inoculated cases treated for plague, 24 proved fatal, 33 recovered, and 5 remained under treatment up to the 5th April, 1899.

Since the opening of the hospital, up to the 15th January, 1898, 77 patients, both inoculated and non-inoculated, were treated with ordinary mercurial and stimulant treatment, out of which 48 died, and 29 recovered. From the 15th January 1898, to the 5th April 1899, 209 non-inoculated patients were treated with native Indian drugs and occasional doses of stimulants, out of which 84 were discharged cured, 12 were still under treatment on the 5th April, 1899, and 113 died.

Of the total number of cases treated, two were treated by Dr. Galeotti with Lustig's curative serum, both of which proved fatal.

I have, &c.
KHAJA ABDULLA.

IV.

LIST of INOCULATED PATIENTS treated in the KHAN BAHADUR MAHOMEDBHOY EBRAHIM KHOJA PLAGUE HOSPITAL BOMBAY, from the DATE of its OPENING, *i.e*, 26th April 1897, up to 5th April 1899.

No.	Name.	Age.	Sex.	Residence.	Date of Inoculation.	Date of Attack.	Date of Admission.	Date of Death.	Date of Discharge.	Remarks.
1	Goolamhosen Mhersally.	Years. 7	Male	Durga Muhalla: Carmally Soorjee's house.	21.4.97	1.1.98	7.1.98	16.1.98	—	According to the statement of his guardians, he was inoculated about 1½ months ago.
2	Mahomed Vishram -	22	Male	Durga Muhalla, 255 -	7.1.98	14.1.98	15.1.98	16.1.98	—	—
*2	Tejbai Mahomed -	23	Female	Palki Muhalla: Mowjee Gheewala's house.	—	10.1.98	13.1.98	16.1.98	—	Inoculated about 1½ months ago, according to the statement of her husband.
3	Fazal Visram -	12	Male	Palki Muhalla: Piroo Mahomed's house.	—	12.1.98	14.1.98	—	29.1.98	Inoculated twice, according to the statement of his father.
4	Hosenally Munjee -	6	Male	Chibra Gali: Pakmodia Street.	5.1.98	13.1.98	15.1.98	—	1.2.98	—
5	Mahomed Visram -	20	Male	Durga Muhalla: Jooma Moosas' house.	6.1.98	14.1.98	15.1.98	16.1.98	—	Inoculated eight days ago according to the statement of his guardians.
6	Goolamally Dossa Cassum.	6	Male	Tantanpura Street: Mooljee Jeewraz's house.	17.1.98	7.2.98	8.2.98	—	21.2.98	Inoculated 20 days ago.
7	Jooma Visram -	21	Male	Palki Muhalla: Ladha Ebram's house.	—	24.2.98	26.2.98	—	31.3.98	Inoculated twice; once by Dr. Yersin's serum last year, and once by Prof. Haffkine's serum this year, about 1½ months ago.
8	Hassan Poonja -	16	Male	Parel - -	19.1.98 26.2.98	27.2.98	28.2.98	—	15.3.98	The patient has got a certificate.
9	Cassum Jeewa Premjee.	12	Male	Durga Muhalla: Carim Munjee's house	26.1.98	28.2.98	1.3.98	—	10.3.98	Inoculated twice. Has got a certificate. Last date of inoculation, 26.1.98.
10	Poorbai, wife of Poonja.	52	Female	Parel - -	5.2.98	1.3.98	7.3.98	9.3.98	—	—
11	Khadija, daughter of Barmal Poonja.	10	Female	Parel - -	5.2.98	1.3.98	8.3.98	—	15.3.98	—
12	Ally Nachoo Allarakia.	6	Male	Nishanpada Cross Lane.	16.2.98	12.3.98	13.3.98	—	22.3.98	—
13	Vally Mahomed Carim.	20	Male	Love Lane: Mazagaon: H.H., Aga Khan's bungalow.	19.1.98	16.3.98	24.3.98	—	12.4.98	—
14	Fazal Meghjee -	10	Male	Durga Muhalla: Carmally Sorjee's house.	30.12.97 7.2.98	23.3.98	27.3.98	—	23.4.98	Inoculated twice. Has got a certificate.
15	Jaffer Walljee Nathoo.	12	Male	Durga Muhalla: Carmally Soorjee's house.	6.1.98 7.2.98	26.3.98	31.3.98	—	12.4.98	Inoculated twice. Has got a certificate.
16	Soanbai, wife of Visram Hurjee.	25	Female	Dongri, Mahomed Rowjee's chawl.	1.3.98	2.4.98	4.4.98	—	18.4.98	Inoculated twice. Last date, 1.3.98.
17	Kallo Momjee -	35	Male	Nesbit's Lane, H. H. Aga Khan's bungalow.	—	6.4.98	9.4.98	—	30.4.98	According to the statement of the brother of the patient, the patient was inoculated about 1½ months previous to attack.
18	Carmally Lootafally	9	Male	Kharak: Ebram Peerbhoys' chawl.	2.2.98 16.2.98	25.4.98	26.4.98	28.4.98	—	Inoculated twice. Has got a certificate.
19	Nanjee Teja - -	19	Male	No. 18, Nishanpada, Cross Lane.	March 1898	1.5.98	4.5.98	5.5.98	—	—
20	Mahomed Warind -	35	Male	No. 416, Parel Road -	27.1.98	1.5.98	10.5.98	12.5.98	—	Inoculated twice in 1897; and twice in 1898. The first date in 1897 is 27.1.98, as per certificate.
21	Hosen Noormahamed.	13	Male	No. 13, Nishanpada Lane.	—	11.5.98	13.5.98	15.5.98	—	Inoculated once in 1898.
22	Noorbai, widow of Jina Damjee.	42	Female	Pajagali: Memon's house.	—	13.5.98	18.5.98	—	4.9.98	Inoculated once four days before the sun eclipse.
23	Moloo Jamal - -	18	Male	Mahim - -	30.3.98 7.4.98	24.5.98	25.5.98	—	12.9.98	—
24	Alibhoy Veerjee Khimjee.	10	Male	Kharak, D. C., Charitable home.	.2.98	7.9.98	10.9.98	—	24.9.98	Inoculated once in Ramzan (Feb.).
25	Foolbai, widow of Canjee Jivraj.	35	Female	Do. - -	—	8.9.98	10.9.98	—	1.10.98	Inoculated twice.
26	Noormahomed Thariff.	19	Male	Hasen Califa Street -	7.9.97 18.3.98	15.9.98	18.9.98	—	8.10.98	—
27	Vallymahomed Carim.	14	Male	No. 1-6, Tandel Street	Jan. or Feb. 1898	24.9.98	27.9.98	28.9.98	—	Inoculated either in January or February 1898, according to the statement of his guardian.
28	Mongee, wife of Noormahomed Veerjee.	13	Female	No. 184, Samuel Street	Jan. 1898	28.9.98	30.9.98	—	28.10.98	Inoculated once only in about January.
29	Dhunjee Laljee Visram.	36	Male	No. 386, Samuel Street	—	28.9.98	1.10.98	—	4.11.98	Inoculated twice in 1898.
30	Esmal Jaffer Nathii	37	Male	No. 526, Dongri Street	Dec. 1897	17.10.98	21.10.98 1.30 p.m.	21.10.98 11.30 p.m.	—	According to his statement, he was inoculated once only in December 1897.
31	Hoorbai, wife of Ramjee Janmahomed.	30	Female	No. 12-20, Dongri Street.	Jan. 1898	1.11.98	3.11.98	—	15.11.98	Inoculated in January 1898.
32	Allymahomed Poonja	12	Male	No. 616, Parel - -	—	10.12.98	12.12.98	—	12.1.99	Inoculated twice in 1898.
33	Bhanjee Alibhoy -	14	Male	No. 95, Chinch Bunder Road.	—	30.12.98	1.1.99	3.1.99	—	Inoculated once only in 1898.
34	Panbai, wife of Mooradally.	28	Female	No. 109, Tandel Street	—	1.1.99	7.1.99	—	22.1.99	Inoculated once only about 12 months ago.
35	Sherbannoo Ebram Veerjee.	13	Female	No. 618, Dongri Street	30.12.97 10.1.98	16.1.99	19.1.99	—	19.2.99	—
36	Fatma, wife of Ebram Veerjee.	33	Female	Do.	—	18.1.99	20.1.99	—	3.2.99	Inoculated thrice in 1898.
37	Verbai, widow of Ebram Ahmed.	6	Female	Do.	Jan. 1898	17.1.99	20.1.99	21.1.99	—	Inoculated in January, 1898.
38	Mariam Thaver Jivroj.	48	Female	No. 8, Kitchen Garden Street.	28.2.98	30.1.99	31.1.99	—	6.3.99	Inoculated twice; last date being 28.2.98 (*vide* certificate).

* Doubtful. The husband of the deceased said she was inoculated in Khoja Muhalla by a Parsee doctor. Professor Haffkine says she was not inoculated.

No.	Name.	Age.	Sex.	Residence.	Date of Inoculation.	Date of Attack.	Date of Admission.	Date of Death.	Date of Discharge.	Remarks.
		Years.								
39	Carmally or Carim Goolamhosein.	18	Male	No. 3, Bhandori Street	—	28.1.99	1.2.99	—	6.3.99	Inoculated once last year, according to his statement.
40	Jaffer Bhanjee Peonja.	47	Male	579-81, Dongri Street	—	7.2.99	2.2.99	11.2.99	—	Inoculated twice in 1898.
41	Jainab Ebram Mahomed.	8	Female	Do.	—	8.2.99	10.2.99	18.2.99	—	Inoculated twice in 1898.
42	Mahomed Dawood Dator.	25	Male	Nil.	—	7.2.99	11.2.99	12.2.99	—	Inoculated once in 1898.
43	Allymahomed Ladha	20	Male	Tantanpura Street	—	9.2.99	12.2.99	—	6.3.99	Inoculated once last year.
44	Nanbai, widow of Jamal Warin.	55	Female	46-48, Jail Road	—	10.2.99	14.2.99	—	6.3.99	Inoculated twice about eight months ago, according to her statement.
45	Avalbai, wife of Remtoola Cassum.	20	Female	9-11, Chuckla Street	—	13.2.99	15.2.99	16.2.99	—	Inoculated once last year, according to the statement of her husband.
46	Alunjee Ramjee Lakha.	35	Male	74, Chinch Bunder	—	18.1.99	20.2.99	23.2.99	—	Inoculated once last year, according to the statement of his relations.
47	Goolamhosen Walljee.	8	Male	Mazagaon	—	24.2.99	25.2.99	—	12.3.99	Do.
48	Sakina, wife of Muradally Joosa.	20	Female	No. 29, Nishanpada Cross Road.	—	2.3.99	4.3.99	—	19.3.99	Do.
49	Goolamhosen Mahomed Dewjee.	6	Male	Kamatipura 5th Lane	—	4.3.99	3.3.99	—	22.3.99	Inoculated twice last year, according to the statement of his guardians.
50	Veerbai, widow of Ebram Sewjee.	28	Female	118, Nishanpada Road	—	7.3.99	9.3.99	12.3.99	—	Inoculated twice about five months ago.
51	Sarabai Mahomed Remtoola.	10	Female	Chinch Puckli	—	6.3.99	9.3.99	11.3.99	—	Inoculated once last year.
52	Jainabai Mahomed Veerjee.	9	Female	No. 594, Dongri Street	—	6.3.99	9.3.99	—	—	Under treatment. Inoculated three times last year, according to the statement of her guardians.
53	Ramjee Teja Dhunjee.	33	Male	No. 46-48, Jail Road	4.3.99	11.3.99	11.3.99	—	—	Under treatment. Inoculated once in 1898, and again in 1899, on 4th March.
54	Remat Bai, widow of Meherally Bhimjee.	35	Female	No. 1-2, Jail Road	—	12.3.99	15.3.99	16.3.99	—	Inoculated twice in 1898.
55	Nazarally, son of Hassum Poonja.	12	Male	Mahatar Pakhdy	—	18.3.99	20.3.99	—	4.4.99	Inoculated once only, about 1½ months ago.
56	Bachoo Jamal	16	Male	No. 1-6, Tandel Street	—	18.3.99	20.3.99	25.3.99	—	Inoculated twice in 1898, according to his statement.
57	Jethai Pardhan Ladha.	19	Female	245-47 Nishanpada	—	19.3.99	21.3.99	—	—	Under treatment. Inoculated twice in 1898.
58	Poorbai Goolamhosen Dossa.	6	Female	185, Nishanpada Road	—	22.3.99	25.3.99	29.3.99	—	Inoculated once in 1898, according to the statement of her guardians.
59	Cachra Shariff	42	Male	Lohargali, Kharak	—	25.3.99	28.3.99	3.4.99	—	Inoculated once last year, as stated by him and his relations.
60	Jainabai Meherally Laljee.	7	Female	240, Samuel Street	—	28.3.99	29.3.99	30.3.99	—	Inoculated once last year.
61	Fatma Datoo Vally	9	Female	526, Dongri Street	—	29.3.99	1.4.99	—	—	Under treatment. Inoculated three times last year.
62	Dosan Nathoo	46	Male	No. 5, Love Lane: H. H. Aga Khan's bungalow.	28.3.99	2.4.99	4.4.99	—	—	Under treatment.

15th April, 1899. KHAJA ABDULLA.

APPENDIX, No. LVI (i).

(*See* Question, No. 18,913).

CASE OF PLAGUE SEPTICÆMIA.

THE ORGANISM RECOVERED FROM THE BLOOD ON 5TH DAY

CONVALESCENCE AND RECOVERY OF PATIENT

POONA PLAGUE HOSPITAL.

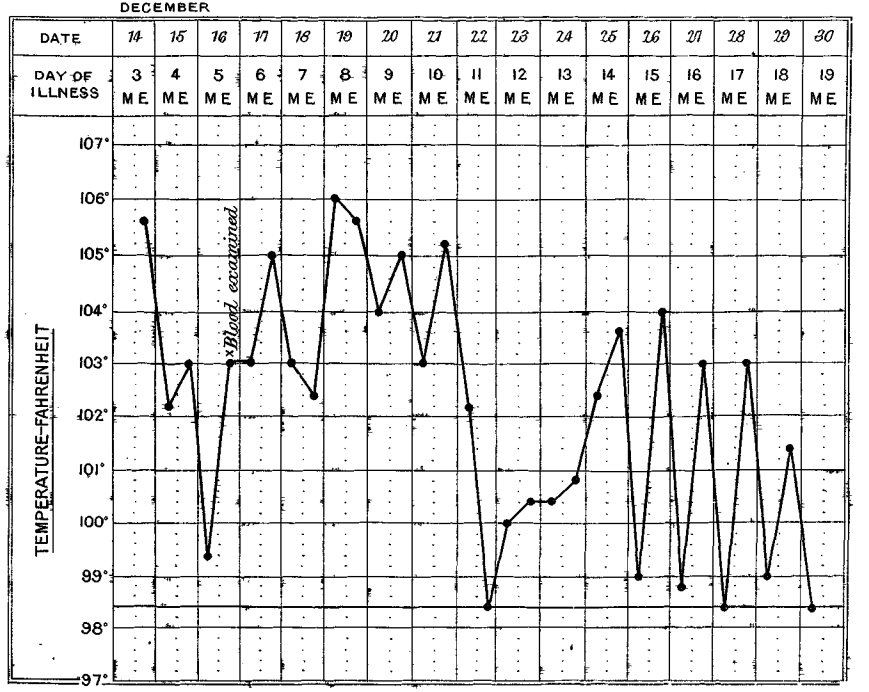
December, 1897.

Male, aged 40, small bubo left femoral region. Patient under a pronounced toxæmia on admission. Pulse feeble. Later (6th day) became semi-comatose and lung showed involvement on 5th day.

Small quantity of blood from vein at back of hand removed by pipette and inoculated on to agar. Four tubes inoculated, each tube yielded colonies of the plague micro-organism within 48 hours' incubation at 37°C. Characteristic broth cultures obtained. A quantity of 24 hours' old broth culture (·25c.c.) inoculated into a rat caused death of animal within 48 hours. Cultures of the plague micro-organism obtained from the blood of the rat.

Crisis on 11th day followed by fever of suppuration up to 19th day. After this slowly convalesced, and was dismissed well 45 days after admission.

E. L. MARSH.



POONA PLAGUE HOSPITAL.

January–February, 1898.

Male, aged 22, bubo in right axilla. Ill for two days before admission. Powerfully built man, lay in dorsal decubitus, semi-conscious, pupils contracted, pulse rapid, but of fairly good quality.

On morning of 6th day of illness small vein at back of left hand opened, and quantity of blood pipetted into sterile tube. Three agar tubes inoculated with the blood, and incubated at 37°C. At end of 24 hours two of the tubes showed several colonies, third tube only showed growth after 48 hours.

Microscopic appearances of growth characteristic of plague. Inoculated a rat with ·25c.c. of broth culture. Rat died of plague within 48 hours.

Four smear preparations of the fresh blood of patient showed the presence of bacteria, resembling B. Pestis in three.

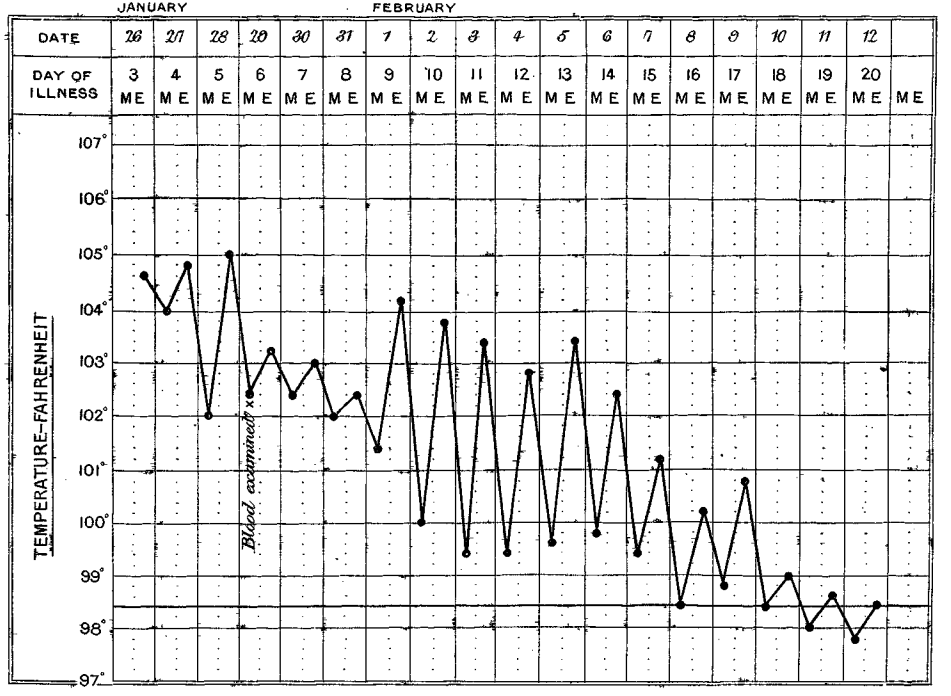
Toxæmic symptoms present on admission lasted till 8th day of illness. Patient kept alive by nasal feeding. Made a good recovery.

E. L. MARSH.

CASE OF PLAGUE SEPTICÆMIA.

THE ORGANISM RECOVERED FROM THE BLOOD ON 6TH DAY

CONVALESCENCE AND RECOVERY OF PATIENT


JANUARY
FEBRUARY
DATE
26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12
DAY OF ILLNESS
3 ME 4 ME 5 ME 6 ME 7 ME 8 ME 9 ME 10 ME 11 ME 12 ME 13 ME 14 ME 15 ME 16 ME 17 ME 18 ME 19 ME 20 ME ME
TEMPERATURE–FAHRENHEIT
107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97°
Blood examined ×

APPENDIX No. LVII.

STATISTICS of MORTALITY from PLAGUE and OTHER CAUSES in the districts of the BOMBAY PRESIDENCY and SIND, during 1896-7-8.

Collectorates.	1896.								1897.								1898.							
	Cholera.	Ratio per 1,000 of Population.	Fevers.	Ratio per 1,000 of Population.	*Plague.*	*Ratio per 1,000 of Population.*	All Causes.	Ratio per 1,000 of Population.	Cholera.	Ratio per 1,000 of Population.	Fevers.	Ratio per 1,000 of Population.	*Plague.*	*Ratio per 1,000 of Population.*	All Causes.	Ratio per 1,000 of Population.	Cholera.	Ratio per 1,000 of Population	Fevers.	Ratio per 1,000 of Population.	*Plague.*	*Ratio per 1,000 of Population.*	All Causes.	Ratio per 1,000 of Population.
Khandesh	1,740	1·19	43,271	29·63	*5*	*0·0*	56,948	39·00	3,351	2·29	43,137	29·54	*76*	*0·05*	62,510	42·81	—	—	17,234	11·80	*240*	*0·16*	41,491	28·41
Nasik	1,136	1·35	25,508	30·33	—	—	36,807	43·76	3,410	4·06	26,853	31·93	*1,075*	*1·28*	46,800	55·64	—	—	11,551	13·73	*2,016*	*2·39*	26,851	31·92
Thana	1,560	1·90	18,815	22·97	*95*	*0·11*	25,409	31·02	2,159	2·63	20,529	25·07	*4,156*	*5·27*	31,200	38·08	7	0·08	15,237	18·61	*3,310*	*4·04*	23,213	28·34
City of Bombay	483	0·60	8,831	10·95	*1,803*	*2·23*	33,050	40·99	1,261	1·56	26,887	33·40	*10,237*	*12·70*	47,475	58·38	—	—	—	—	*18,130*	*22·49*	—	—
Kolaba	1,239	2·08	12,453	20·94	*13*	*0·02*	18,349	30·85	2,528	4·25	12,158	20·44	*1,309*	*2·20*	22,978	38·63	15	0·03	7,437	12·50	*660*	*1·11*	14,065	23·65
Ahmednagar	2,892	3·26	19,175	21·60	*4*	*0·01*	32,280	36·36	3,700	4·17	17,173	19·35	*356*	*0·13*	39,393	44·37	2	0·01	4,191	4·72	*263*	*0·29*	19,301	21·74
Poona	6,340	5·97	23,526	22·16	*59*	*0·02*	37,163	35·01	9,138	8·62	34,205	32·22	*8,871*	*8·36*	60,454	56·95	1	—	14,979	14·11	*1,332*	*1·25*	24,228	22·82
Sholapur	980	1·30	15,803	21·06	*1*	*0·0*	20,886	27·83	4,262	5·68	18,771	25·02	*2,353*	*3·14*	38,182	50·89	3	—	7,245	9·66	*1,735*	*2·31*	15,864	21·14
Satara	3,708	3·03	30,772	25·10	—	—	41,471	33·84	11,064	9·03	39,394	32·15	*10,031*	*8·18*	67,301	54·92	2	—	14,981	12·22	*6,907*	*5·63*	32,880	26·83
Ratnagiri	291	0·26	18,369	16·61	—	—	26,754	24·19	1,799	1·63	17,638	15·95	*26*	*0·02*	33,321	30·13	—	—	13,979	12·64	*373*	*0·34*	21,921	19·82
Belgaum	3,136	3·10	13,881	13·72	—	—	30,147	29·81	7,499	7·41	15,869	15·69	*444*	*0·44*	42,201	41·72	93	0·09	17,571	17·37	*16,739*	*16·55*	38,768	38·33*
Dharwar	2,008	1·91	16,541	15·75	—	—	29,764	23·33	1,760	1·68	20,464	19·48	*98*	*0·04*	38,809	36·94	3,986	3·79	29,686	28·26	*26,774*	*25·49*	55,502	52·83*
Bijapur	5,249	6·59	11,932	14·98	—	—	23,200	29·13	4,614	5·79	20,271	25·46	*3*	*0·00*	36,888	46·32	3	0·00	7,556	9·49	*1,076*	*1·35*	15,390	19·33
Kanara	120	0·27	6,765	15·17	—	—	11,781	26·41	413	0·93	8,176	18·33	—	—	15,656	35·09	79	0·18	6,340	14·65	*36*	*0·08*	11,985	26·86
Surat	1,142	1·76	18,433	28·37	*21*	*0·03*	22,695	34·92	123	0·19	15,650	24·08	*3,070*	*4·72*	25,270	38·88	—	—	10,403	16·00	*2,417*	*3·72*	20,420	31·42
Broach	677	1·98	11,346	33·23	*5*	*0·01*	13,652	39·98	10	0·03	9,159	26·82	*9*	*0·03*	11,824	34·63	—	—	9,288	27·20	*418*	*1·22*	13,016	38·12
Kaira	807	0·93	26,324	30·20	*10*	*0·01*	32,911	37·76	10	0·01	19,330	29·18	*3*	*0·00*	25,580	29·35	—	—	15,059	17·29	*402*	*0·46*	24,439	28·04
Panch Mahals	342	1·09	8,687	27·74	—	—	9,661	30·82	7	0·02	6,179	19·72	—	—	6,616	21·11	—	—	7,684	24·52	*197*	*0·62*	8,670	27·67
Ahmedabad	1,549	1·68	26,344	28·61	*29*	*0·03*	32,960	35·78	—	—	20,077	21·80	*65*	*0·08*	26,668	28·95	1	0·00	18,662	20·26	*5*	*0·00*	25,332	27·51
Karachi	—	—	11,807	21·04	*59*	*0·10*	13,965	24·89	1	—	13,590	24·22	*3,572*	*6·37*	17,115	30·51	—	—	9,616	17·14	*2,723*	*4·85*	13,951	23·09
Hyderabad	—	—	14,154	16·01	*1*	*0·0*	15,436	17·46	—	—	11,967	13·54	*499*	*0·57*	14,069	15·92	—	—	7,781	8·80	*1*	*0·00*	9,758	11·04
Thar and Parkar	5	0·02	6,667	20·06	—	—	7,151	21·51	—	—	5,865	17·64	*2*	*0·00*	6,600	19·86	—	—	4,403	13·25	—	—	4,847	14·58
Shikarpur	—	—	19,010	20·77	*1*	*0·0*	20,050	21·91	—	—	25,465	27·83	*716*	*0·78*	28,974	31·66	—	—	15,801	17·2	—	—	18,279	19·98
Jacobabad	—	—	3,815	21·27	—	—	3,982	22·82	—	—	3,789	21·71	*3*	*0·02*	4,032	23·11	—	—	2,780	15·93	—	—	3,017	17·29

* The figures given in roman type against Belgaum and Dharwar for 1898 are for 11 months. The plague figures are for the entire year.

APPENDIX No. LVIII.

NOTES AND CHARTS

by

MR. N. A. F. MOOS,
DIRECTOR OF THE KOLABA OBSERVATORY, BOMBAY,

on

the RELATION of PLAGUE and METEOROLOGICAL CONDITIONS in BOMBAY,

With a Note by

DR. BUCHAN,
SECRETARY TO THE METEOROLOGICAL SOCIETY FOR SCOTLAND.

I.

SOURCE and EXPLANATION of the METHODS of REDUCTION of ENTRIES in the TABLES 1-5 and PLATES A, B, B (i.), B (ii.), and C.

In compiling the following tables, the entries given in the published volumes of observations at the Government Observatory, Kolaba, have been invariably adopted. It is only where a few entries were not so available, that the original manuscript abstracts were consulted and the missing entries filled in. In every case the modes of operation have been precisely the same as those adopted in reducing the entries given in the printed volumes, and in no case has a new departure from the usual methods been attempted.

TABLES 1 AND 2.

Barometer and Temperature of the Air.

1846.—Monthly means were taken from the manuscript abstracts from which annual means were calculated and adopted. All other entries of the year have been taken from the manuscript abstracts directly.

1847-1895.—From 1847 to 1872, all entries have been taken directly from the Meteorology of the Bombay Presidency, and from 1873 to 1895, from the volumes 23 to 34 of Bombay Magnetical and Meteorological Observations.

TABLE 3.

Pressure of Vapour.

1846.—Monthly means of dry and wet-bulb thermometers taken from manuscript abstracts were reduced to monthly means of pressure of vapour by the formula given in the Meteorology of the Bombay Presidency for the years 1847 to 1861. The maxima and minima were derived by a process of inspection and reduced as above.

1847-1895.—From 1847 to 1872, the entries have been taken directly from the Meteorology of the Bombay Presidency, and from 1873 to 1895, from Volumes 23 to 34 of Bombay Magnetical and Meteorological Observations.

TABLE 4.

Wind.

1846.—Monthly means of pressure in lbs. per square foot were taken from manuscript abstracts from which the annual mean was calculated and adopted. Hourly, daily, and monthly maximum pressures were directly obtained from the abstracts and adopted. For the average direction of the year, instead of getting the daily average from 24 hourly observations, a particular mean hourly direction was selected which corresponded with the average direction of the day, to which the usual average process was applied, and from the monthly means so derived the annual mean was finally obtained and adopted.

1847-1872.—Annual mean pressure in lbs. per square foot for the years 1847 to 1865, given in Volumes 3 to 22 were taken directly and adopted, as also the annual average directions for the years 1847 to 1863. The force of wind in eight principal directions during the years 1864 and 1865, and in 16 directions in the years 1866 and 1867, as given in the Volumes 21 and 22, were taken and resolved into north and east components, and resultant directions were found therefrom and adopted. Annual mean velocities for 1866 to 1872, as given in Volumes 22 and 23, were directly adopted. Mean resultant directions for 1868 to 1872 were derived from the annual components of wind given in Volumes 22 and 23, and adopted. All other entries for 1847 to 1872 were directly taken from the Meteorology of the Bombay Presidency.

1873-1895.—Annual mean velocities and maximum mean daily and monthly velocities have been taken from Bombay Magnetical and Meteorological Observations, Volumes 23 to 34. Mean resultant directions were reduced from the annual components of wind given in the above volumes and adopted. Maximum hourly mean velocities were derived from data prepared for the yearly Government administration reports.

TABLE 5.

Rainfall.

1846-1872.—All entries have been taken directly from the Meteorology of the Bombay Presidency, except that of maximum *daily* rainfall for the year 1846, which was taken from manuscript abstracts.

1873-1895.—All entries have been taken from Volumes 23 to 34 of the Bombay Magnetical and Meteorological Observations.

PLATES A, B, B (i), and B (ii).

Variations of the Temperature of the Air and Ground.

The accompanying plates have been put in to show that what is true for the yearly variation of ground evaporation is true also for the day. In the yearly fluctuations the resulting curve shows that in the colder and drier months the ground evaporation is a maximum, and in the hotter and moist months it is a minimum. The Tables A. and B. will show that during the day the worst hours are the early morning hours, when the temperature of and the tension of moisture in the air is a minimum; and the best hours are the afternoon hours, when both the temperature and tension of moisture are a maximum.

PLATE C.

Movement and Intensity of Wind.

In regard to Plate C., which represents the movement of wind and measures the intensity from hour to hour of land and sea breezes, it may be noted that this factor supplies a valuable health giving component, *ozone*, and should be adequately represented in any curve which is drawn to run coincident with the mortality curve. Unfortunately the treatment adopted in this inquiry gives the curve in terms of either pressure or temperature, and the velocity being a factor of a different order, it cannot be compounded with the above. The only possible way, therefore, to include this factor in the curve is by finding the ratio of the velocity in terms of temperature by the method of least squares, a ratio which gives the resultant curve coincident with the mortality curve with the least probable error. As such computations are heavy, no systematic effort has been made except in an arbitrary, rough manner, the result of which is shown by dotted curves in the series of trial curves which I have prepared.

Statement of Mean Values and Charts A. and B.

The tables 1 to 5 and the plates A. to C. are followed by a statement of the weekly mean values of the meteorological factors used in the calculations, and the result of the calculations is appended in Chart A., which gives a series of trial curves, and in Chart B. which gives the curves for plague mortality and ground evaporation in Bombay.

N. A. F., MOOS,
Director,
Government Observatory, Bombay.

TABLE 1.

Barometric Pressure.

1846–1895.

Year.	Annual Mean.	Individual Hours.			Daily Means.			Monthly Means.		
		Maximum.	Minimum.	Extreme Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1846	29·809	30·107	29·383	0·724	30·032	29·493	0·539	**29·993**	29·624	0·369
1847	·797	·075	·458	·617	·017	·498	·519	·917	·621	·296
1848	·805	·084	·445	·639	·012	·491	·521	·927	·649	·278
1849	·798	·094	·387	·707	·016	·428	·588	·945	·624	·321
1850	·808	·070	·482	·588	29·998	·521	·477	·949	·739	·310
1851	·796	·148	·414	·734	30·036	·462	·574	·958	**·599**	·359
1852	·805	·072	·433	·639	·001	·485	·516	·929	·630	·299
1853	·814	·113	·502	·611	·022	·536	·486	·955	·644	·311
1854	·804	·111	**·183**	·928	·031	·514	·517	·935	·618	·317
1855	·824	·119	·462	·657	·048	·513	·535	·944	·658	·286
1856	·806	·136	·439	·697	·068	·524	·544	·985	·610	·375
1857	·808	·105	·507	·598	·039	·541	·498	·981	·640	·341
1858	·812	·093	·464	·629	·018	·516	·502	·944	·670	·274
1859	·812	·061	·437	·624	29·994	·492	·502	·923	·628	·305
1860	·804	·095	·452	·643	30·012	·496	·516	·953	·631	·322
1861	·797	·053	·429	·624	29·975	·506	·469	·932	·639	·293
1862	·783	·101	·467	·634	30·017	·511	·506	·920	·625	·295
1863	·792	·108	·457	·651	·018	·500	·518	·947	·606	·341
1864	·832	·142	·486	·656	·054	·567	·487	·945	·660	·285
1865	·811	·109	·456	·653	·039	·496	·543	·972	·656	·316
1866	·822	**·164**	·342	·822	**·076**	·452	·624	·969	·661	·308
1867	·824	·143	·514	·629	·058	·564	·494	·988	·667	·316
1868	·836	·131	·344	·787	·053	·413	·640	·963	·673	·290
1869	·814	·132	·463	·669	·046	·503	·543	·966	·659	·307
1870	·797	·094	·418	·676	·015	·478	·537	·936	·637	·299
1871	·805	·068	·466	·602	29·996	·521	·475	·932	·641	·291
1872	·795	·067	·515	·552	·980	·569	·411	·932	·640	·292
1873	·811	·095	·440	·655	30·012	·513	·499	·943	·641	·302
1874	·810	·102	·378	·724	·024	·445	·579	·975	·628	·347
1875	·808	·080	·465	·615	·013	·500	·513	·938	·652	·286
1876	·816	·091	·465	·626	·022	·542	·480	·957	·631	·326
1877	·846	·108	·540	·568	·049	·600	·449	·976	·713	·263
1878	·800	·106	·467	·639	·022	·517	·505	·953	·654	·299
1879	·801	·080	·294	·786	·003	**·402**	·601	·924	·673	·251
1880	·818	·103	·477	·626	·033	·561	·472	·975	·668	·307
1881	·820	·120	·504	·616	·041	·540	·501	·963	·677	·287
1882	·807	·140	·366	·774	·058	·433	·625	·965	·633	332
1883	·812	·132	·469	·663	·053	·545	·508	·989	·639	·350
1884	·827	·136	·419	·717	·053	·472	·581	·993	·448	·345
1885	·826	·125	·404	·721	·051	·470	·581	·987	·652	·335
1886	·809	·132	·362	·770	·057	·461	·596	·947	·653	·294
1887	·838	·130	·406	·724	·060	·466	·594	·985	·662	·273
1888	·832	·130	·537	·593	·061	·585	·476	·975	·664	·311
1889	·818	·096	·394	·702	·028	·475	·553	·970	·647	·323
1890	·814	·094	·505	·589	·028	·552	·471	·447	·632	·315
1891	·834	·128	·471	·657	·045	·522	·523	·960	·653	·307
1892	·790	·084	·418	·666	·017	·492	·525	·968	·608	·360
1893	·815	·081	·432	·649	·014	·518	·496	·958	·648	·310
1894	·809	·094	·451	·643	·021	·498	·523	·945	·636	·309
1895	·819	·105	·390	·715	·026	·436	·590	·936	·654	·282
Mean of 50 years	29·811									

TABLE 2.

Temperature of the Air and Ground.

1846–95 extended to 1898.

Year.	Annual Mean.	Individual Hours.			Daily Means.			Monthly Means.			Ground Temperature: Annual Mean.	
		Maximum.	Minimum.	Extreme Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	20-inch deep.	60-inch deep.
	°	°	°	°	°	°	°	°	°	°		
1846	89·5	98·8	63·8	35·0	88·4	72·6	15·8	86·7	76·4	10·3	—	—
1847	79·0	94·2	**53·3**	40·9	86·5	**62·2**	24·3	83·9	73·7	10·2	—	—
1848	79·8	98·0	57·0	41·0	86·7	67·1	19·6	84·6	75·1	9·5	—	—
1849	79·6	96·5	58·5	38·0	86·6	65·9	20·7	85·2	73·3	11·9	83·6	—
1850	79·9	97·0	60·0	37·0	87·8	68·1	19·7	84·4	72·4	12·0	84·1	—
1851	79·5	93·3	57·3	36·0	86·7	65·6	21·1	84·6	72·2	12·4	81·6	83·5
1852	80·2	95·4	57·4	38·0	88·3	66·7	21·6	86·3	71·9	14·4	81·7	83·6
1853	80·5	96·4	58·6	37·8	89·4	67·0	22·4	86·9	71·6	15·3	81·7	83·6
1854	80·6	98·4	63·0	35·4	89·4	74·3	18·1	86·9	75·0	11·9	82·2	83·9
1855	80·7	95·3	60·0	35·3	88·5	69·2	19·3	86·0	74·7	11·3	81·7	83·6
1856	80·5	94·6	63·0	31·6	88·1	72·6	15·5	86·1	75·4	10·7	82·0	84·0
1857	79·9	**100·2**	63·0	37·2	87·6	70·9	16·7	86·1	73·9	12·2	80·9	83·0
1858	80·1	94·9	60·8	34·1	88·0	69·0	19·0	86·2	73·3	12·9	80·8	82·5
1859	80·2	98·4	62·0	36·4	88·0	69·7	18·3	85·2	74·2	11·0	81·2	82·9
1860	80·0	93·7	59·6	34·1	88·1	68·3	19·8	85·0	72·3	12·7	82·2	83·6
1861	79·3	97·0	62·5	34·5	87·6	70·6	17·0	85·2	74·4	10·8	82·2	83·9
1862	80·6	94·0	61·4	32·6	87·8	69·6	18·2	85·8	72·9	12·9	84·0	84·2
1863	79·8	95·0	60·2	34·8	87·9	67·3	20·6	86·0	74·3	11·7	83·8	84·0
1864	79·9	94·0	60·7	33·3	87·6	68·9	18·7	84·4	71·3	13·1	83·2	83·6
1865	81·0	96·0	66·1	29·9	**89·5**	73·2	16·3	**87·6**	77·0	10·6	84·2	84·5
1866	78·3	91·8	56·6	35·2	86·3	65·3	21·0	82·7	71·8	10·9	82·5	83·3
1867	78·8	92·6	61·8	30·8	87·4	70·0	17·4	84·7	73·1	11·6	82·1	83·2
1868	79·1	92·5	62·2	30·3	85·9	69·4	16·5	84·5	72·9	11·6	82·2	83·4
1869	79·9	92·4	63·3	29·1	86·4	72·2	14·2	84·1	75·3	8·8	82·8	83·7
1870	79·0	92·7	62·9	29·8	86·3	68·9	17·4	83·7	73·6	10·1	82·5	83·7
1871	80·1	93·3	66·1	27·2	86·7	70·6	16·1	85·6	74·9	10·7	83·0	83·8
1872	78·9	93·3	60·4	32·9	86·7	68·1	18·6	84·1	71·7	12·4	82·2	83·1
1873	78·9	93·2	55·2	38·0	87·7	65·4	22·3	84·0	72·1	11·9	82·2	83·2
1874	78·3	93·0	60·9	32·1	85·8	66·7	19·1	83·7	**71·1**	12·6	81·6	82·6
1875	79·3	91·2	59·1	32·1	86·8	66·3	20·5	83·8	72·2	11·6	82·3	83·1
1876	79·3	91·1	65·8	25·3	86·6	71·3	15·3	84·4	74·9	9·5	82·6	83·5
1877	80·3	91·3	63·2	28·1	87·1	69·9	17·2	84·0	74·4	9·6	83·0	83·8
1878	80·1	94·8	62·8	32·0	87·4	69·6	17·8	85·1	73·3	11·8	83·3	84·0
1879	78·6	95·5	65·4	31·1	87·5	70·6	16·9	82·9	73·1	9·8	81·9	82·9
1880	79·5	91·9	60·4	31·5	86·1	67·6	18·5	84·5	73·0	11·5	82·5	82·9
1881	80·0	92·0	67·1	24·9	86·5	73·5	13·0	85·1	76·1	9·0	83·4	84·2
1882	79·1	92·1	65·1	27·0	85·6	71·7	13·9	83·6	74·9	8·7	82·9	83·8
1883	78·8	90·9	62·8	28·1	86·3	69·4	16·9	84·2	72·8	11·4	82·6	83·8
1884	78·8	91·9	63·1	28·8	86·4	68·9	17·5	83·5	71·9	11·6	82·7	83·4
1885	79·2	91·8	62·1	29·7	87·3	68·7	18·6	84·3	72·3	12·0	83·1	83·6
1886	79·5	95·4	59·5	35·9	87·4	67·4	20·0	85·0	73·5	11·5	83·5	84·1
1887	78·7	92·2	56·9	35·3	85·8	67·0	18·8	84·2	72·6	11·6	82·6	83·4
1888	80·1	93·8	65·7	28·1	86·6	71·2	15·4	84·1	74·1	10·0	83·7	84·1
1889	79·6	92·1	65·7	26·4	87·4	72·7	14·7	85·4	74·6	10·8	83·7	84·5
1890	79·3	91·1	66·2	24·2	86·1	72·1	14·0	83·9	75·1	8·8	83·3	84·0
1891	79·5	90·8	60·3	30·5	86·8	67·3	19·5	84·9	73·5	11·4	83·4	84·1
1892	79·9	93·9	64·4	29·5	89·0	70·4	18·6	85·7	75·5	10·2	83·7	84·4
1893	78·9	92·1	59·8	32·3	86·0	68·1	17·9	83·6	72·1	11·5	82·9	83·6
1894	79·6	90·4	65·1	25·3	86·7	71·9	14·8	84·6	75·1	9·5	83·7	84·4
1895	79·6	92·3	62·0	30·3	86·6	69·1	17·5	84·1	73·2	10·9	83·5	84·2
Mean of 50 years	79·6										Mean of 1849 to 1895, 82·7	Mean of 1851 to 1895, 83·6
1896	80·7										84·5	84·8
1897	79·5										83·9	84·9
1898	80·3										86·3	86·3

TABLE 3.

Pressure of Vapour.

1846–1895.

Year.	Annual Mean.	Individual Hours.			Daily Means.			Monthly Means.		
		Maximum.	Minimum.	Extreme Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1846	0·809	1·116	0·318	0·798	1·022	0·478	0·544	0·961	0·612	0·349
1847	·795	·099	·189	·910	0·985	**·259**	·726	·934	·606	·328
1848	·803	·046	·303	·743	·987	·330	·657	·918	·629	·289
1849	·796	**·214**	·280	·934	1·060	·351	·709	**·969**	·588	·381
1850	·784	·076	·270	·806	0·983	·392	·591	·942	·566	·376
1851	·782	·030	·236	·794	·988	·348	·640	·929	·555	·374
1852	·769	·069	·265	·804	·961	·369	·592	·920	·508	·412
1853	·765	·028	·247	·781	·974	·353	·621	·934	·511	·423
1854	·795	·124	·198	·926	1·025	·337	·688	·946	·557	·389
1855	·794	·110	·297	·813	·002	·439	·563	·947	·596	·351
1856	·796	·076	·300	·776	0·977	·425	·552	·933	·625	·308
1857	·792	·125	·321	·804	**1·067**	·475	·592	·933	·566	·367
1858	·815	·139	·360	·779	·044	·479	·565	·968	·625	·343
1859	·809	·155	·369	·786	·040	·439	·601	·957	·608	·349
1860	·800	·088	·299	·789	·019	·465	·614	·956	·562	·394
1861	·772	·066	·260	·806	0·982	·402	·580	·921	·565	·356
1862	·778	·055	·304	·751	·983	·423	·560	·934	·553	·381
1863	·759	·000	·267	·733	·927	·390	·537	·902	·577	·325
1864	·748	·040	·219	·821	·948	·359	·589	·900	**·484**	·416
1865	·789	·107	·353	·754	·989	·488	·501	·930	·607	·323
1866	·762	·089	·235	·854	·978	·336	·642	·932	·545	·387
1867	·784	·046	·282	·764	·987	·428	·559	·947	·560	·307
1868	·785	·091	**·128**	·963	1·023	·335	·688	·953	·583	·370
1869	·787	·052	·272	·780	0·992	·433	·559	·930	·608	·322
1870	·772	·044	·244	·800	·976	·432	·544	·915	·566	·349
1871	·800	·051	·346	·705	·959	·474	·485	·915	·632	·283
1872	·758	·091	·217	·874	·996	·348	·648	·925	·515	·410
1873	·755	·055	·223	·832	1·005	·285	·720	·906	·532	·374
1874	·743	·083	·232	·801	0·964	·353	·611	·892	·513	·379
1875	·760	·031	·215	·816	·973	·321	·652	·911	·515	·396
1876	·751	0·994	·340	·654	·956	·474	·482	·892	·584	·308
1877	·788	1·022	·257	·765	·964	·349	·615	·916	·583	·333
1878	·795	·100	·252	·848	·999	·383	·616	·921	·563	·358
1879	·748	·049	·281	·768	1·009	·400	·609	·909	·552	·357
1880	·767	·085	·262	·773	0·964	·379	·585	·891	·533	·358
1881	·774	·014	·286	·728	·959	·417	·542	·904	·579	·325
1882	·764	·047	·283	·764	1·007	·435	·572	·908	·597	·311
1883	·758	·027	·297	·730	0·963	·388	·575	·921	·525	·396
1884	·756	0·994	·330	·664	·938	·440	·498	·896	·544	·352
1885	·769	1·129	·273	·856	1·013	·355	·658	·926	·536	·390
1886	·780	·096	·194	·902	·048	·366	·682	·920	·570	·350
1887	·759	·014	·198	·821	0·958	·303	·655	·882	·574	·308
1888	·794	·067	·357	·710	·977	·412	·565	·931	·618	·313
1889	·787	·050	·329	·721	1·001	·461	·540	·939	·599	·340
1890	·771	·009	·337	·672	0·952	·478	·474	·907	·589	·318
1891	·757	·029	·206	·823	·970	·309	·661	·919	·568	·351
1892	·792	·050	·298	·752	·984	·452	·532	·923	·631	·302
1893	·759	·015	·253	·762	·976	·373	·597	·899	·548	·351
1894	·784	·087	·344	·748	·959	·485	·474	·929	·616	·313
1895	·776	·030	·333	·697	·965	·420	·545	·923	·580	·343
Mean of 50 years.	0·778									

TABLE 4.

Wind.

1846-1895.

Year.	Annual Mean Pressure.	Average Direction.	Absolute Maximum Pressure.	Maximum Mean Daily Pressure.	Maximum Mean Monthly Pressure.	Year.	Annual Mean Velocity.	Mean Resultant Direction.	Maximum Hourly Mean Velocity.	Maximum Mean Daily Velocity.	Maximum Mean *Monthly* Velocity.
	lb.		lb.	lb.	lb.		Miles.		Miles.	Miles.	Miles.
1846	·44	N.W.	4·16	1·94	0·65	1866	14·36	W.	58·7	46·2	22·5
1847	·39	N.W.	3·60	1·63	0·65	1867	12·4	W.N.W.	41	32·1	19·4
1848	·32	N.W.	5·26	3·21	0·68	1868	12·3	W.N.W.	50	39·5	19·9
1849	·25	N.W.	9·00	2·31	0·64	1869	12·5	W.N.W.	59	38·5	20·7
1850	·2	W.N.W.	15·00	1·60	0·37	1870	11·8	W.N.W.	41	31·5	19·5
1851	·18	N.W.	8·00	3·00	0·49	1871	12·6	W.N.W.	48	32·1	21·3
1852	·16	N.W.	10·70	1·00	0·39	1872	12·2	W.N.W.	46	32·3	19·8
1853	·2	N.W.	7·00	1·40	0·51	1873	12·5	W.N.W.	43	30·0	23·0
1854	·18	N.W.	35·00	8·06	0·33	1874	11·9	W.N.W.	47	36·5	19·6
1855	·24	N.W.	13·00	2·05	0·52	1875	12·1	W.N.W.	45	33·5	21·0
1856	·20	N.W.	16·00	3·08	0·37	1876	12·7	W.N.W.	43	30·7	22·7
1857	·21	N.W.	9·50	1·29	0·51	1877	11·7	W.N.W.	43	33·0	18·7
1858	·26	N.W.	12·00	2·38	0·55	1878	11·6	W.N.W.	47	30·7	15·7
1859	·33	N.W.	11·25	4·29	1·02	1879	12·4	W.N.W	56	39·5	17·2
1860	·29	W.N.W.	14·00	2·01	0·48	1880	12·0	W.N.W.	34	30·8	19·7
1861	·37	W.N.W.	8·75	2·26	0·71	1881	12·3	W.N.W.	40	31·6	20·5
1862	·41	N.W.	10·75	4·02	0·67	1882	11·8	W.N.W.	53	34·2	20·3
1863	·38	W.N.W.	7·75	3·05	0·92	1883	12·2	W.N.W.	45	31·8	20·4
1864	·32	*W.N.W	6·25	1·25	0·62	1884	12·1	W.N.W.	36	29·0	18·6
1865	·31	*W.N.W.	10·50	1·95	0·51	1885	12·4	W.N.W.	56	41·1	18·4
						1886	11·7	W.N.W.	48	35·2	16·9
						1887	12·0	W.N.W.	44	30·2	20·6
						1888	12·0	W.N.W.	50	27·3	19·9
						1889	11·5	W.N.W.	59	39·8	17·2
						1890	12·1	W.N.W.	40	26·4	20·4
						1891	12·0	W.N.W.	41	33·2	18·1
						1892	11·0	W.	48	31·6	19·0
						1893	11·1	W.N.W.	39	30·0	14·6
						1894	10·9	W.N.W.	42	34·1	17·5
						1895	11·1	W.N.W.	44	30·7	17·8

* From the year 1864 the average direction is replaced by resultant direction.

TABLE 5.

Rainfall.

1846–1895.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total.	Number of Rainy Days.	Maximum Fall in One Day.	Time of Occurrence.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.		In.	
1846	—	—	—	—	—	26·41	33·19	6·65	6·65	1·03	—	—	73·93	104	5·16	16 July.
1847	0·90	0·02	—	0·31	1·40	37·56	16·45	8·68	5·68	0·28	5·53	—	76·00	120	12·54	11 June.
1848	—	—	—	0·59	5·67	39·98	13·90	7·37	2·32	5·84	0·19	—	75·86	90	8·14	14 June.
1849	0·34	—	—	—	—	23·41	50·99	12·06	26·13	0·75	0·61	—	114·89	100	6·35	25 July.
1850	—	—	—	—	—	14·80	20·15	5·39	4·77	4·89	0·25	—	50·25	103	4·61	17 July.
1851	—	—	—	—	0·52	24·50	47·03	20·63	3·89	0·04	0·07	—	96·07	89	6·51	25 August.
1852	—	—	0·01	—	0·30	21·76	22·17	11·16	12·67	0·19	—	1·01	69·27	100	7·09	22 June.
1853	—	0·05	0·02	—	—	33·70	13·05	5·95	9·83	—	—	—	62·60	84	9·89	18 June.
1854	—	—	—	—	—	16·84	38·95	3·90	13·61	7·49	1·85	—	82·14	114	5·55	14 June.
1855	—	—	—	—	—	20·18	11·83	3·82	5·29	0·06	—	—	41·18	91	4·79	20 June.
1856	—	—	—	—	2·09	24·66	24·48	6·73	7·78	0·06	—	0·12	65·92	109	10·23	9 June.
1857	—	—	—	—	0·57	9·26	8·74	15·71	14·21	2·78	—	—	51·27	108	5·27	1 August.
1858	—	—	—	0·15	1·57	14·44	20·12	7·48	15·47	3·22	—	—	62·45	105	6·15	11 September.
1859	—	—	—	—	—	20·87	28·70	14·59	5·24	1·06	—	—	77·16	91	8·20	12 June.
1860	—	—	—	—	0·03	21·97	22·39	7·11	8·15	2·50	—	—	62·15	93	7·31	13 June.
1861	—	—	—	—	0·63	15·43	25·34	30·35	3·24	1·86	—	—	76·91	99	6·08	18 August.
1862	—	—	—	—	0·01	22·31	15·10	12·65	21·69	1·42	0·45	—	73·63	107	6 16	21 June.
1863	0·41	—	—	0·11	0·07	23·41	30·78	10·60	9·98	2·32	—	—	77·68	109	8·14	24 July.
1864	—	—	—	—	0·01	15·42	13·36	10·72	5·59	—	0·47	—	45·57	95	3·56	26 June.
1865	0·38	—	—	—	—	10·61	18·23	36·42	4·36	6·16	1·14	—	77·85	104	7·86	2 July.
1866	—	0·11	—	—	—	13·47	40·34	20·34	3·44	0·74	—	—	78·44	98	7·63	11 July.
1867	—	—	—	—	—	8·70	20·39	22·21	6·80	5·07	0·13	—	63·30	110	5·41	16 July
1868	—	—	0·01	—	—	13·52	20·43	20·29	7·11	0·14	0·02	—	62·12	107	10·23	9 August.
1869	—	—	—	—	0·03	26·22	23·89	15·24	22·56	3·55	0·05	0·12	91·66	102	15·31	27 June.
1870	—	—	0·03	0·02	—	21·73	26·43	6·27	7·08	4·65	—	—	66·21	109	4·71	18 June.
1871	2·22	—	—	—	1·25	8·91	9·96	8·95	6·01	0·25	2·97	0·06	40·58	107	4·64	31 August.
1872	—	—	—	—	0·06	24·43	24·84	9·49	16·59	1·07	—	—	76·48	98	9·23	12 September.
1873	—	0·05	—	—	0·51	20·36	16·98	23·96	7·77	0·07	—	—	69·70	101	6·23	24 August.
1874	—	—	—	—	0·05	18·68	41·24	11·14	11·05	0·02	—	—	82·18	103	4·48	21 July.
1875	0·47	0·05	—	—	—	23·97	15·14	11·95	31·51	—	—	—	83·09	97	8·14	5 September.
1876	—	—	—	—	0·01	12·97	23·69	8·66	4·71	—	—	—	50·04	83	7·59	26 July.
1877	0·23	0·51	0·02	—	—	34·61	10·75	10·78	6·60	6·39	—	—	69·89	99	14·60	19 June.
1878	0·03	—	—	0·02	0·03	20·49	47·64	20·02	16·90	4·17	2·63	—	111·93	113	5·55	5 July.
1879	—	—	0·03	—	5·23	16·56	11·21	22·36	5·61	0·40	—	—	61·40	111	3·78	30 July.
1880	—	0·01	0·02	—	—	21·48	18·37	4·08	22·80	1·18	—	—	67·94	109	8·20	2 July.
1881	—	—	0·04	—	0·36	15·29	29·47	19·06	4·56	4·17	0·09	—	73·04	113	11·30	3 August.
1882	—	0·04	0·02	0·08	0·02	27·54	26·94	3·36	10·08	1·12	0·03	—	69·23	105	10·18	3 June.
1883	0·12	—	—	—	0·33	13·65	39·88	12·57	12·57	10·40	0·86	—	90·13	123	6·85	13 July.
1884	0·03	—	—	—	—	13·25	25·87	15·29	17·04	2·22	0·60	1·14	75·44	110	7·37	13 July.
1885	—	—	—	—	0·02	5·11	21·81	25·42	12·01	3·54	—	—	67·91	113	10·29	15 August.
1886	—	—	—	0·01	0·96	43·45	35·79	10·69	6·54	1·69	0·81	—	99·74	110	16·10	18 June.
1887	—	—	—	0·02	0·09	24·07	30·98	17·59	18·23	2·79	1·02	0·16	94·95	112	7·84	10 September.
1888	1·85	0·02	0·10	—	—	15·76	22·47	11·43	4·92	0·11	1·16	—	57·82	107	4·66	14 July.
1889	—	—	—	—	0·67	19·89	30·45	10·32	2·71	3·80	—	—	67·84	103	4·04	8 July.
1890	—	—	—	0·01	0·06	24·55	21·54	10·61	6·45	0·58	1·25	0·13	65·18	116	4·61	19 June.
1891	—	—	0·20	—	—	13·99	32·48	6·94	22·53	1·04	—	—	77·18	100	5·82	1 September.
1892	—	—	—	—	0·11	13·30	23·86	36·56	18·73	1·89	0·67	—	95·42	114	5·43	31 August.
1893	—	0·14	—	0·02	6·30	21·47	16·14	13·55	7·54	0·45	1·63	—	67·24	124	4·97	20 June.
1894	0·22	—	0·6	0·01	—	16·87	26·16	8·40	12·04	3·08	—	0·01	66·85	124	4·77	21 July.
1895	—	0·07	—	—	0·08	17·84	18·04	15·97	11·91	3·62	0·06	—	67·69	109	6·82	7 September.
Average of 50 years.	0·13	0·02	0·01	0·03	0·58	20·30	24·74	13·23	10·65	2·20	0·49	0·05	72·44	105	—	

PLATE A.

DIURNAL VARIATION IN THE TEMPERATURE OF THE AIR, (1866 TO 1872.)

From Observations recorded at the Kolaba Observatory, Bombay.

INEQUALITIES AT DIFFERENT HOURS IN THE SAME MONTH.

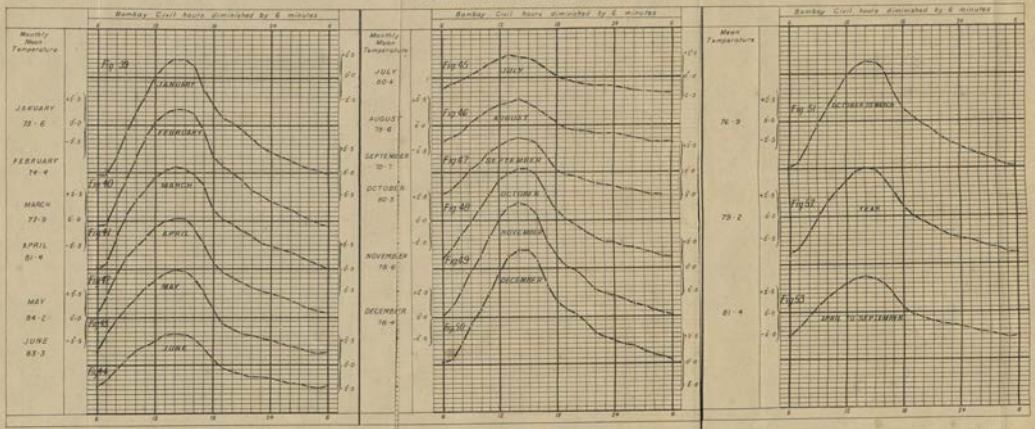


PLATE B

VARIATIONS IN THE TEMPERATURE OF THE GROUND.

From Observations recorded at the Kolaba Observatory, Bombay.

Pressure of vapour. Diurnal variation (1866 to 1870). Black curves.
Additional capacity. Diurnal variation (1866 to 1870). Violet curves.
Inequalities of different hours in the same month.
The same scale applies to the two curves.

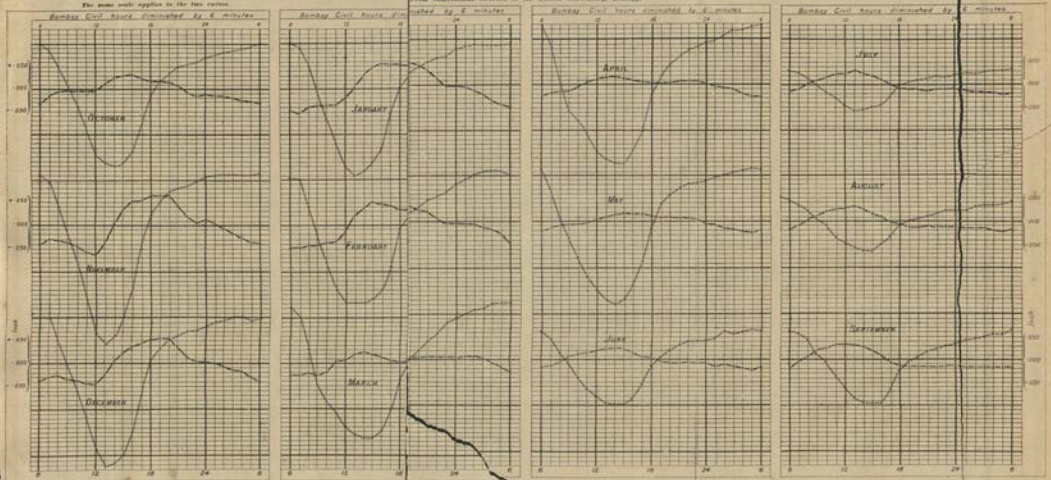


PLATE B (i).

Pressure of vapour *Diurnal variation (1866 to 1872)* *Black curves.*
Additional capacity *Diurnal variation (1866 to 1872)* *Violet curves.*
Inequalities at different hours in yearly and six-monthly periods.

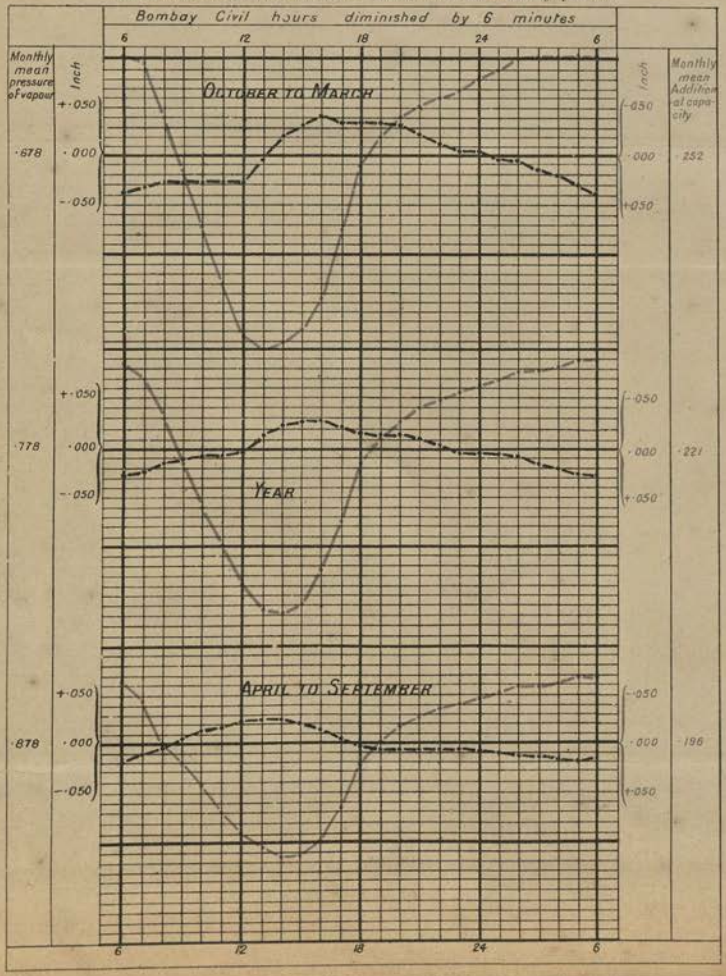


TABLE OF MONTHLY AVERAGES.

Month.	Monthly mean pressure of vapour.	Monthly mean additional capacity.
October	·847	·198
November	·692	·292
December	·644	·271
January	·587	·249
February	·595	·262
March	·707	·254
April	·811	·266
May	·874	·303
June	·931	·212
July	·904	·133
August	·882	·128
September	·869	·146

PLATE B (ii).

VARIATIONS IN THE TEMPERATURE OF THE GROUND.

From Observations recorded at the Kolaba Observatory, Bombay.

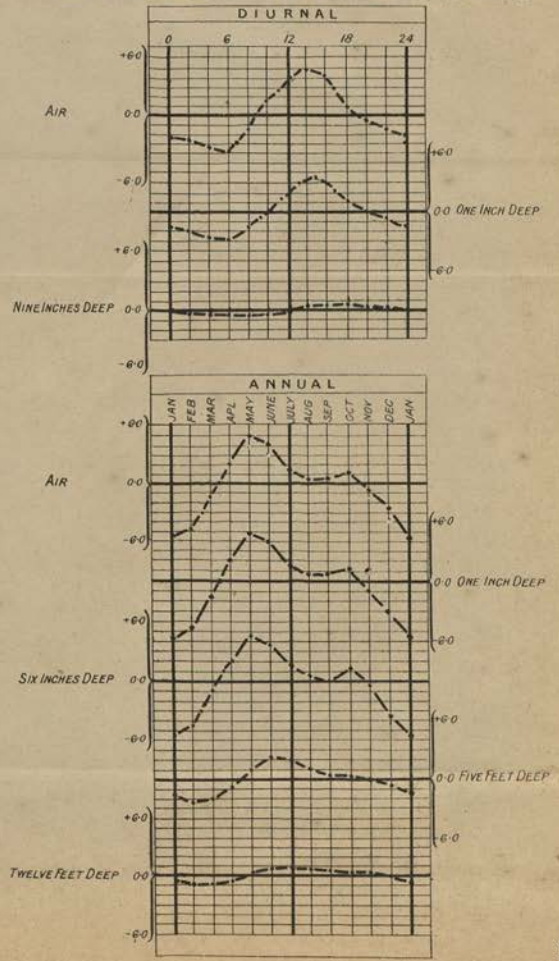


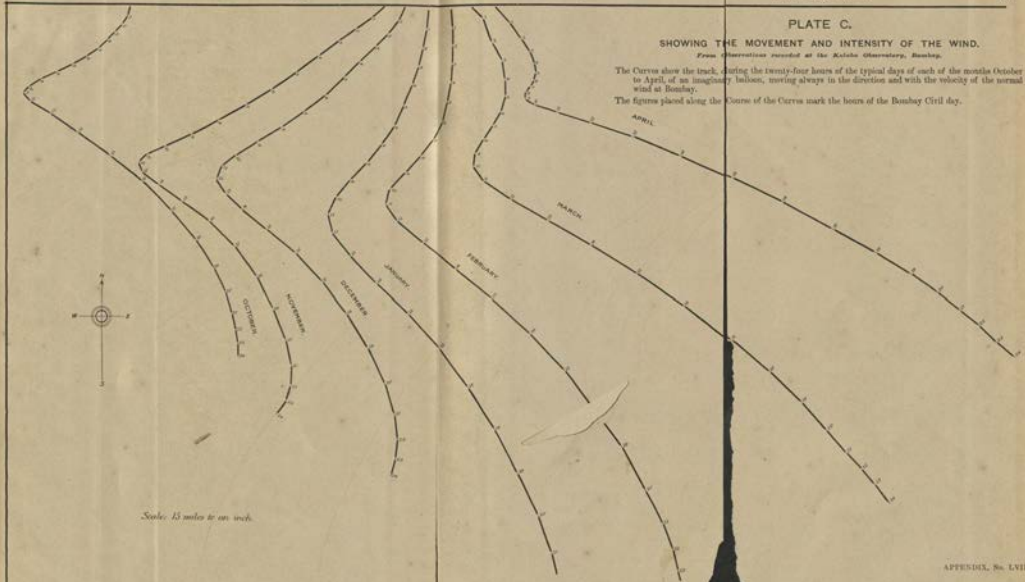
PLATE C.

SHOWING THE MOVEMENT AND INTENSITY OF THE WIND.

From Observations recorded at the Kolaba Observatory, Bombay.

The Curves show the track, during the twenty-four hours of the typical days of each of the months October to April, of an imaginary balloon, moving always in the direction and with the velocity of the normal wind at Bombay.

The figures placed along the Course of the Curves mark the hours of the Bombay Civil day.



Scale: 15 miles to an inch.

Byrd & Spottiswoode, Lith. London

STATEMENT

SHOWING

THE WEEKLY MEAN VALUES

OF

DIFFERENT METEOROLOGICAL FACTORS

AND

OFFICIAL FIGURES OF MORTALITY

USED IN THE PREPARATION OF THE

FOLLOWING CHARTS.

App. LVIII.

STATEMENT showing the WEEKLY MEAN VALUES of different METEOROLOGICAL FACTORS used in the CALCULATIONS and FIGURES of MORTALITY published in the "GOVERNMENT GAZETTE."

Abbreviations:—t = Temperature of air; t' = Temperature of evaporation; T = Temperature of dew point; t_{20} = Temperature of ground at 20″ depth; t_{60} = Temperature of ground at 60″ depth; F, f′ = Tension corresponding to saturation of T, t'; P = Weekly atmospheric pressure.

Date for the Week ending	t.	t'.	T.	t_{20}.	t_{60}.	$F = f' - a(t - t')\frac{P-f'}{30}$.	1 − F, or 1 − Col. 7.	$t_{20} - t$, or Col. 5 − Col. 2.	$t_{60} - t$, or Col. 6 − Col. 2.	$t_{60} - t'$, or Col. 6 − Col. 3.	$t_{60} - T$, or Col. 6 − Col. 4.	T − (t_{20} − t). In Terms of Temperature, or Col. 4 − Col. 9.	T − (t_{20} − t). In Terms of Tension corresponding to Temperatures.	T − (t_{60} − t). In Terms of Temperature, or Col. 4 − Col. 10.	T − (t_{60} − t). In Terms of Tension corresponding to Temperatures.	P.	Wind.	Pressure of Vapour derived from the formula, $F' = f' - a(t_{60} - t')\frac{P-f'}{30}$.	Dew Point corresponding to F′.	Mortality Figures as given in "Government Gazette."	Mortality Figures, Average of Five previous Years corresponding to Col. 19.	Mortality Figures from 7th August 1894, Average of Five previous Years, as given in "Government Gazette."	Mortality Figures from 2nd August 1897, Average of Five previous Years, as given in "Government Gazette."	Mortality Figures, Daily Average derived from Col. 22.	Col. 8 × Col. 10.
1.	2.	3.	4.	5.	6.	7.	8.	9.	11.	10.	12.	13.		14.		15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
4 Aug. 1896	79·0	76·6	75·7	44·8	86·1	·890	·110	5·8	7·1	9·5	10·4	69·9	·731	68·6	·699	29·594	—	·811	73·0	564	564	492	470	66	·7810
11 „ „	80·3	77·3	76·3	84·4	85·6	·905	·095	4·1	5·3	8·3	9·3	72·2	·790	71·0	·758	·743	—	·845	74·2	598	534	482	466		·5035
18 „ „	78·6	76·2	75·3	84·0	85·4	·877	·123	5·4	6·8	9·2	10·1	69·9	·731	68·5	·697	·705	—	·802	72·7	650	538	474	472		·8364
25 „ „	80·7	76·9	75·5	83·8	85·0	·881	·119	3·1	4·3	8·1	9·5	72·4	·795	71·2	·764	·777	—	·835	73·9	669	581	545	449		·5117
1 Sept. „	80·9	76·1	74·3	83·9	84·7	·849	·151	3·0	3·8	8·6	10·4	71·3	·766	70·5	·746	·795	—	·805	72·8	667	540	495	469		·5738
8 „ „	81·8	76·1	74·0	84·1	84·6	·838	·162	2·3	2·8	8·5	10·6	71·7	·777	71·2	·764	·817	—	·806	72·8	593	531	505	461		·4536
15 „ „	81·9	76·0	73·7	84·2	84·5	·831	·169	2·3	2·6	8·5	10·8	71·4	·769	71·1	·761	·819	—	·803	72·7	618	492	497	450	65	·4394
22 „ „	82·2	76·1	73·8	84·2	84·4	·834	·166	2·0	2·2	8·3	10·6	71·8	·779	71·6	·774	·837	—	·808	72·9	647	506	489	457		·3652
29 „ „	83·1	78·4	76·8	84·5	84·4	·921	·079	1·4	1·3	6·0	7·6	75·4	·879	75·5	·882	·815	—	·905	76·3	720	527	492	435		·1027
6 Oct. „	85·4	79·7	77·8	85·1	84·6	·954	·046	−0·3	−0·8	4·9	6·8	78·1	·961	78·6	·977	·819	—	·959	78·0	791	491	462	432		·0368
13 „ „	83 9	78·7	76·8	85·8	84·9	·923	·077	1·9	1·0	6·2	8·1	74·9	·865	75·8	·891	·855	—	·913	76·5	634	498	482	419	61	·0770
20 „ „	83·8	78·1	76·0	85·7	84·9	·900	·100	1·9	1·1	6·8	8·9	74·1	·842	74·9	·865	·892	—	·886	75·6	606	477	456	414		·1100
27 „ „	84·3	77·5	75·0	85·9	85·1	·870	·130	1·6	0·8	7·6	10·1	73·4	·822	74·2	·845	·920	—	·859	74·7	698	470	428	433		·1040
3 Nov. „	84·0	74·5	70·5	86·1	85·3	·751	·249	2·1	1·3	10·8	14·8	68·4	·694	69·2	·713	·902	—	·733	70·0	668	443	432	414		·3237
10 „ „	83·6	75·7	72·5	85·8	85·5	·802	·198	2·2	1·9	9·8	13·0	70·3	·741	70·6	·748	·873	—	·779	71·8	623	449	426	400	58	·3762
17 „ „	83·6	74·1	70·1	85·8	85·5	·737	·263	2·2	1·9	11·4	15·4	67·9	·682	68·2	·689	·830	—	·715	69·3	704	462	442	398		·4997
24 „ „	80·2	71·9	68·1	85·7	85·5	·696	·304	5·5	5·3	13·6	17·4	62·6	·568	62·8	·572	·824	—	·631	65·6	760	446	418	406		1·6112
1 Dec. „	80·2	74·7	73·5	84·1	85·3	·798	·202	3·9	5·1	10·6	12·8	68·6	·699	67·4	·671	·927	—	·742	70·4	772	457	433	403		1·0302
8 „ „	80·4	72·4	69·0	84·8	85·5	·711	·289	3·9	5·1	13·1	16·5	65·1	·619	63·9	·594	·955	—	·649	66·5	1,051	460	433	411		1·4739
15 „ „	79·8	68·6	62·7	84·0	85·0	·575	·425	4·2	5·2	16·4	22·3	58·5	·491	57·5	·474	·962	—	·515	59·9	1,310	470	453	410	60	2·2100
22 „ „	79·2	69·9	65·3	83·5	84·9	·633	·367	4·3	5·7	15·0	19·6	61·0	·537	59·6	·511	·915	—	·564	62·4	1,416	470	462	429		2·0919
29 „ „	77·1	69·8	66·1	83·0	84·6	·653	·347	5·9	7·5	14·8	18·5	60·2	·522	58·6	·493	·975	—	·562	62·3	1,853	—	462	431		2·6025
5 Jan. 1897	75·2	67·6	63·4	81·9	84·6	·599	·401	6·7	9·4	17·0	21·2	56·7	·461	54·0	·418	·952	—	·485	58·2	1,711	494	451	418		3·7694
12 „ „	78·1	71·5	68·5	81·8	84·3	·699	·301	3·7	6·2	12·8	15·8	64·8	·618	62·3	·562	·930	—	·638	65·5	1,638	484	457	440	63	1·8662
19 „ „	72 0	64·5	60·2	81·2	83·8	·526	·474	9·2	11·8	19·3	23·6	51·0	·374	48·4	·340	·972	—	·390	52·1	1,758	501	465	451		5·5932

| | | |

Table showing the Weekly Mean Values of different Meteorological Factors—*continued.*

Date for the Week ending.	t.	t'.	T.	t_{20}.	t_{60}.	$F' = f' - a(t-t')\frac{P-f'}{30}$	1 − F, or 1 − Col. 7.	$t_{20} - t$, or Col. 5 − Col. 2.	$t_{60} - t$, or Col. 6 − Col. 2.	$t_{60} - t'$, or Col. 6 − Col. 3.	$t_{60} - T$, or Col. 6 − Col. 4.	T − (t_{20} − t). In Terms of Temperature, or Col. 4 − Col. 9.	T − (t_{20} − t). In Terms of Tension corresponding to Temperatures.	T − (t_{60} − t). In Terms of Temperature, or Col. 4 − Col. 10.	T − (t_{60} − t). In Terms of Tension corresponding to Temperatures.	P.	Wind.	Pressure of Vapour derived from the formula, $F' = f' - a(t_{60} - t')\frac{P-f'}{30}$.	Dew Point corresponding to F'.	Mortality Figures as given in "Government Gazette."	Mortality Figures, Average of Five previous Years corresponding to Col. 19.	Mortality Figures from 7th August 1894, Average of Five previous Years as given in "Government Gazette."	Mortality Figures from 2nd August 1887, Average of Five previous Years as given in "Government Gazette."	Mortality Figures, Daily Average derived from Col. 22.	Col. 8. × Col. 10.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.		14.		15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
23 Nov. 1897	78·3	69·1	64·5	83·9	85·2	·610	·390	5·6	6·9	16·1	20·7	58·9	·498	57·6	·476	29·914	1·7 E.	·531	60·7	682	—	—	—	—	2·6910
30 „ „	78·2	69·2	64·6	83·3	84·9	·613	·387	5·1	6·7	15·7	20·3	59·5	·509	57·9	·481	·902	2·7 E.	·538	61·1	704	—	—	—	—	2·5929
7 Dec. „	77·8	69·4	65·5	82·9	85·0	·627	·373	5·1	7·2	15·6	19·5	60·4	·525	58·3	·488	·941	3·2 E.	·544	61·4	706	—	—	—	—	2·6856
14 „ „	76·1	68·3	64·3	82·4	84·5	·606	·394	6·3	8·4	16·2	20·2	58·0	·482	55·9	·447	·937	0·7 E.	·511	59·6	785	—	—	—	—	3·3096
21 „ „	76·0	65·4	59·2	82·0	84·4	·511	·489	6·0	8·4	19·0	25·2	53·2	·406	50·8	·372	·948	3·7 E.	·413	53·7	835	—	—	—	—	4·1076
28 „ „	75·4	66·9	62·3	81·5	84·0	·566	·434	6·1	8·6	17·1	21·7	56·2	·452	53·7	·413	·963	2·7 E.	·468	57·2	975	—	—	—	—	3·7824
4 Jan. 1898	74·2	66·8	63·0	81·3	84·0	·578	·422	7·1	9·8	17·2	21·0	—	—	53·2	·406	·999	0·8 W.	·465	57·0	1,061	—	—	—	—	4·1356
11 „ „	74·2	65·8	61·1	80·7	83·6	·541	·459	6·5	9·4	17·8	22·5	—	—	51·7	·384	·982	0·7 E.	·435	55·1	1,807	—	—	—	—	4·3146
18 „ „	77·1	67·3	62 0	80·7	83·5	·563	·437	3·6	6·4	16·2	21·5	—	—	55·6	·443	·949	3·2 E.	·487	58·3	1,540	—	—	—	—	2·7968
25 „ „	76·9	68·3	64·0	81·5	83·4	·601	·399	4·6	6·5	15·1	19·4	—	—	57·5	·474	·957	1·3 E.	·523	60·3	1,726	—	—	—	—	2·5935
1 Feb. „	77·9	69·6	65·6	81·8	83·6	·634	·366	3·9	5·7	14·0	18·0	—	—	59·9	·516	·927	0·2 E.	·567	62·6	1,871	—	—	—	—	2·0862
8 „ „	77·3	68·8	65·1	82·0	83·5	·621	·379	4·7	6·2	14·7	18·4	—	—	58·9	·498	·864	1·2 W.	·540	61·2	2,067	—	—	—	—	2·3498
15 „ „	75·1	67·1	62·9	81·8	83·4	·577	·423	6·7	8·3	16·3	20·5	—	—	54·6	·427	·865	3·8 W.	·482	58·0	2,195	—	—	—	—	3·5109
22 „ „	75·0	66·6	61·5	81·4	83·4	·565	·435	6·4	8·4	16·8	21·9	—	—	53·1	·404	·857	3·3 W.	·465	57·0	1,574	—	—	—	—	3·6540
1 Mar. „	79·2	73·2	70·6	81·7	83·6	·754	·246	2·5	4·4	10·4	13·0	—	—	66·2	·644	·890	2·7 W.	·701	68·7	2,080	—	—	—	—	1·0824
8 „ „	77·2	67·8	62·3	82·2	83·5	·589	·411	5·0	6·3	15·7	21·2	—	—	56·0	·449	·879	2·6 W.	·505	59·3	2,184	—	—	—	—	2·5893
15 „ „	80·4	73·4	70·3	83·0	83·7	·746	·254	2·6	3·3	10·3	13·4	—	—	67·0	·662	·844	3·0 W.	·708	69·0	2,137	—	—	—	—	·8382
22 „ „	81·3	73·9	70·7	84·1	83·9	·758	·242	2·8	2·6	10·0	13·2	—	—	68·1	·687	·822	5·8 W.	·725	69·7	2,268	—	—	—	—	·6292
29 „ „	81·4	74·5	71·7	84·7	84·5	·778	·222	3·3	3·1	10·0	12·8	—	—	68·6	·699	·820	5·2 W.	·742	70·4	1,938	—	—	—	—	·6882
5 April „	82·9	73·7	69·7	85·4	84·9	·730	·270	2·5	2·0	11·2	15·2	—	—	67·7	·678	·808	6·9 W.	·707	68·9	1,519	—	—	—	—	·5400
12 „ „	83·0	75·9	73·1	—	85·1	·816	—	—	2·1	9·2	—	—	—	71·0	·758	·788	4·7 W.	·792	72·3	1,303	—	—	—	—	
19 „ „	84·0	78·2	76·2	—	85·6	·904	—	—	1·6	7·4	—	—	—	74·6	·856	·796	5·8 W.	·884	75·6	1,202	—	—	—	—	
26 „ „	84·7	78·7	76·6	—	86·1	·914	—	—	1·4	7·4	—	—	—	75·2	·873	·759	5·8 W.	·900	76·1	1,116	—	—	—	—	
3 May „	86·3	79·7	77·5	—	86·3	·940	—	—	0·0	6·6	—	—	—	77·5	·943	·729	6·5 W.	·941	77·4	872	—	—	—	—	
10 „ „	85·6	77·9	75·1	—	86·9	·872	—	—	1·3	9·0	—	—	—	73·8	·838	·743	7·8 W.	·856	74·6	725	—	—	—	—	
17 „ „	85·8	77·4	74·4	—	87·3	·851	—	—	1·5	9·9	—	—	—	72·9	·809	·808	7·9 W.	·830	73·7	616	—	—	—	—	
24 „ „	86·0	79·2	76·9	—	87·8	·925	—	—	1·8	8·6	—	—	—	75·1	·871	·736	9·1 W.	·902	76·2	633	—	—	—	—	
31 „ „	86·9	80·1	77·7	—	88·1	·951	—	—	1·2	8·0	—	—	—	76·5	·912	·739	6·6 W.	·939	77·4	589	—	—	—	—	

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CHART A.—TRIAL CURVES SHOWING THE RELATION BETWEEN PLAGUE AND METEOROLOGICAL CONDITIONS IN BOMBAY.

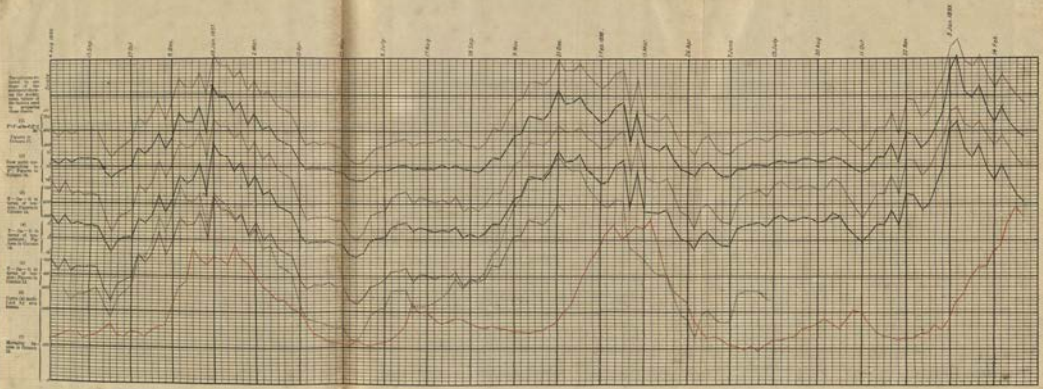
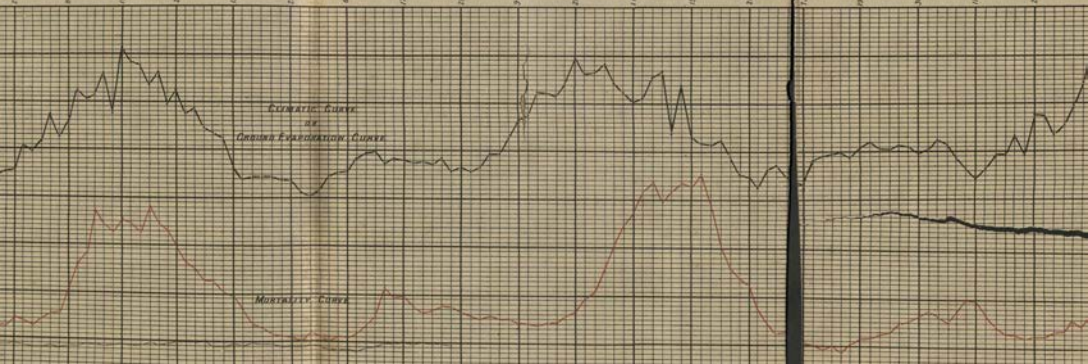


CHART B. SHOWING GROUND EVAPORATION AND PLAGUE MORTALITY IN BOMBAY.



Remarks on the Weather and Plague at Bombay, 1896–99,

by Alexander Buchan, LL.D., F.R.S.,

Secretary to the Meteorological Society for Scotland.

In the table appended to these remarks are set forth the mean weekly averages calculated from Professor Moos's figures for the $2\frac{3}{4}$ years, from August 1896 to March 1899, as follows:—

1. The average weekly number of deaths from all causes during the period dealt with. To this is added the average weekly number of deaths for the five years, 1893–97, when there was no plague; and the differences between these two sets of average weekly mortality which show, presumably, the average weekly mortality from the plague from its commencement to March 1899, embraced in Professor Moos's Report.
2. The mean weekly dry bulb and wet bulb at Bombay for the $2\frac{3}{4}$ years, these columns showing respectively the temperature of the air, and the temperature of the evaporation at Bombay.
3. The mean weekly relative humidity calculated from the dry and wet bulb means, this column showing the degree of humidity of the air at Bombay.
4. The mean weekly temperature of the soil at a depth of five feet, to which is added a column showing the weekly differences between this soil temperature and that of the air over the soil.
5. The mean weekly rainfall, in inches, at Bombay during the time.

These results are graphically represented on the diagram accompanying the tables.

I do not think it necessary to give any of the other meteorological data in illustration of the remarks, such as dew-point, barometric pressure, &c., as these do not appear to show any connection with the curve of mortality.

Weekly Mortality.—It will be seen that during the five years when there was no plague at Bombay, the weekly mortality varied only slightly during the year, the extremes being 475 deaths in the tenth week, and 392 deaths in the twenty-eighth week, the weekly average for the year being 439 deaths.

In striking contrast with this remarkable steadiness of the weekly mortality is the weekly mortality during the $2\frac{3}{4}$ years of the plague, the extremes now being 1,980 deaths on the tenth week of the year, and 474 deaths on the twenty-fifth week.

The annual march of the mortality through the weeks is shown by Diagram A. The result shows two maxima and two minima, the former, and by far the larger, maximum reaching its culmination from January to March, and the latter from August to October.

The larger maximum is practically coincident with the coldest weather of the year, and such weather particularly during the night, and, considered in connection with the habits, housing, and clothing of the population, may perhaps account for a part of this great mortality. The mortality falls steadily from the absolute maximum to the end of June, when the absolute minimum of the mortality occurs, all this taking place with a rising temperature which attains its maximum in June. From this time the humidity increases to the maximum which stretches over the next four months. This period covers the rainy season, and it is during this time that the secondary maximum mortality from plague occurs.

Thus, the two maxima occur respectively when the weather at Bombay is coldest and driest, and when the weather is wettest and still very warm.

A prominent feature of the mortality curve is that the curve of no single meteorological element taken by itself—such as temperature of air, B; humidity, C; temperature of soil, D; or rainfall, E—agrees with the mortality curve.

Such a curve of agreement, however, is obtained from the differences between the temperature of the soil at a depth of 5 feet, D, to which the daily changes of temperature do not penetrate, and the temperature of the air over the soil, F. To show this more impressively, the figures in the diagram A and F are both coloured black. A very important point in the relations of the two curves is that all the phases of F precede in time by a week or two the corresponding phases of A, just as in the case of London, where the commencement of hot or cold weather precedes by a week or two the increased mortality which results from these types of weather.

Since the temperature of the soil, at a depth to which the daily changes do not reach, is higher than the air over it, amounting to from 4° to 11° during the high mortality from plague, it follows that at these times the "*Grundluft*," or air in the soil, will rise out of the soil most readily and pass into the air, carrying with it the noxious impurities in the soil.

This connection between the curve of mortality and these temperatures' curve opens up a field of research to the physician and the bacteriologist, and the research is all the more likely to lead to good results when it is kept in mind that the principal maximum mortality of the year occurs when the weather is coldest and driest, and the secondary maximum when the weather is moistest and wettest, and the temperature very high.

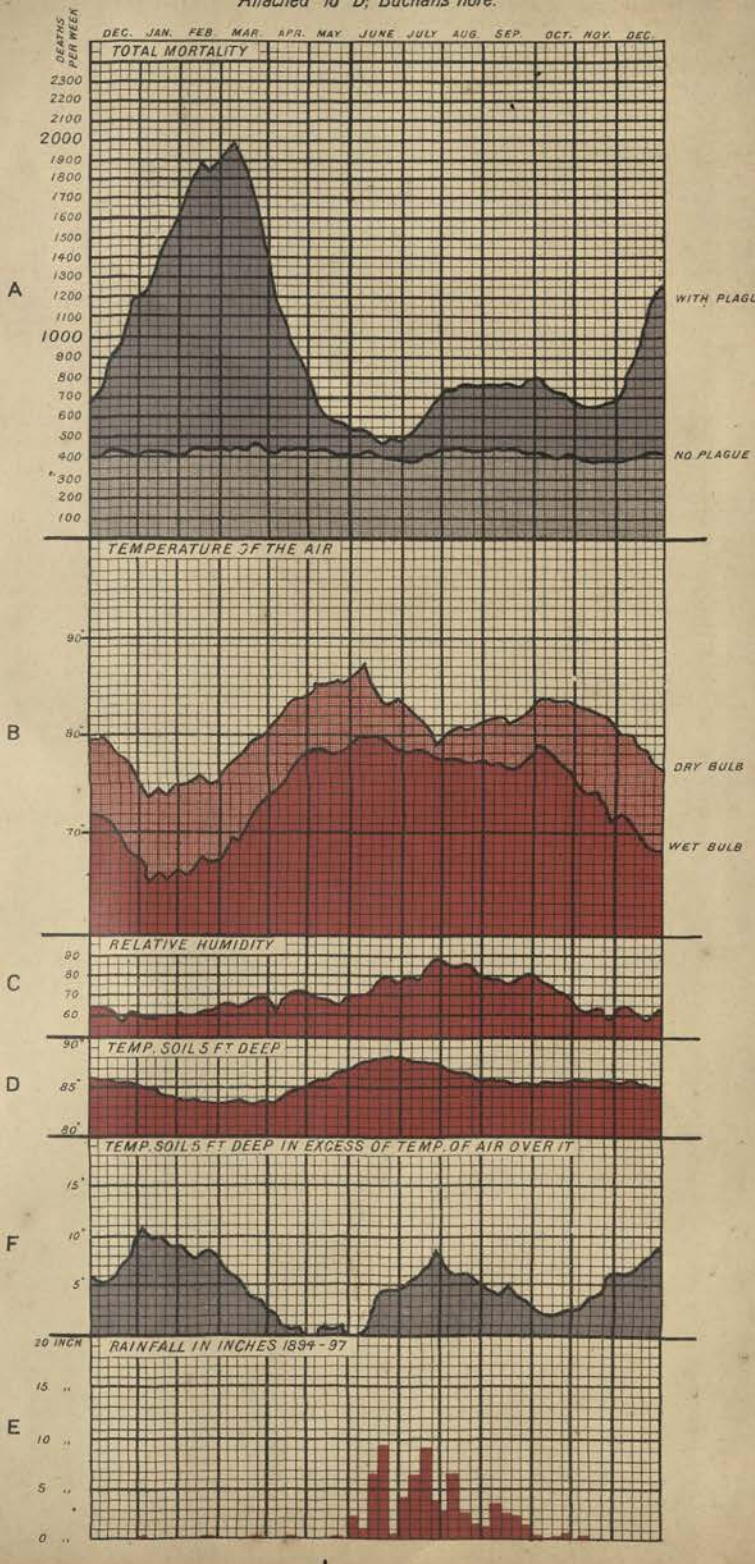
Edinburgh, 2nd September 1899. (Signed) A. Buchan.

TABLE showing the MEAN WEEKLY MORTALITY, TEMPERATURE, HUMIDITY, and RAINFALL at BOMBAY, in Connection with the PLAGUE there.
Attached to Dr. Buchan's Note.

—	—	Deaths.		Excess with Plague.	Temperature.		Relative Humidity.	Temperature of Soil. 5 feet.	Excess of Soil Temperature.	Rain.
		1883-7. No Plague.	1896-9. With Plague.		Dry.	Wet.				
					°	°		°	°	Ins.
January	1	418	1,222	804	74·0	66·0	61	84·9	10·9	·04
	2	440	1,352	912	74·9	66·4	60	84·5	9·6	—
	3	451	1,512	1,061	74·1	65·9	61	84·1	10·0	—
	4	443	1,632	1,189	75·3	67·0	61	83·9	8·6	—
February	5	434	1,706	1,272	75·2	66·8	61	83·8	8·6	—
	6	463	1,863	1,400	76·3	68·1	62	83·6	7·3	—
	7	450	1,910	1,460	75·2	67·7	64	83·4	8·2	·02
	8	465	1,844	1,378	75·4	68·0	64	83·4	8·0	·02
March	9	467	1,938	1,471	77·4	70·3	66	83·5	6·1	—
	10	475	1,980	1,505	77·7	69·9	64	83·4	5·7	—
	11	469	1,902	1,433	79·1	71·8	66	83·5	4·4	—
	12	493	1,704	1,211	80·0	73·0	68	83·3	3·3	·01
	13	441	1,540	1,099	80·3	73·6	69	83·7	3·4	·01
April	14	442	1,263	821	81·4	73·5	64	83·5	2·1	—
	15	463	1,137	674	83·2	76·0	68	84·1	0·9	—
	16	455	1,019	564	84·1	78·0	72	84·5	0·4	·01
	17	466	894	428	84·4	78·2	72	85·2	0·8	—
May	18	459	755	296	85·6	78·8	69	85·5	0·1	—
	19	463	642	179	85·4	77·9	67	86·0	0·6	—
	20	444	582	138	85·7	78·0	66	86·3	0·6	·01
	21	445	587	142	85·8	79·1	70	86·9	1·1	·06
June	22	438	545	107	87·0	80·2	70	87·1	0·1	2·23
	23	452	555	103	87·6	80·1	69	87·6	0·0	1·29
	24	431	508	77	84·4	80·0	78	87·8	3·4	6·66
	25	403	474	71	83·2	79·4	82	88·1	4·9	9·56
	26	400	525	125	83·8	78·6	75	80·0	4·2	·65
July	27	397	495	98	83·1	78·5	79	87·9	4·8	4·27
	28	392	550	158	82·1	78·5	76	87·8	5·7	6·80
	29	422	623	201	80·9	78·0	86	87·4	6·5	9·26
	30	441	677	236	78·9	77·6	88	87·5	8·6	3·95
August	31	470	750	280	80·6	77·6	85	86·9	6·3	3·00
	32	466	739	273	80·8	77·6	84	86·4	5·6	6·03
	33	472	794	322	80·2	77·0	85	86·3	6·1	2·76
	34	449	767	318	81·2	77·3	81	86·0	4·8	1·59
September	35	469	764	295	81·6	76·9	77	85·8	4·2	1·17
	37	461	767	306	81·9	77·0	77	85·8	3·9	3·85
	37	450	772	322	80·6	76·6	74	85·7	5·1	2·53
	38	457	755	298	81·7	77·0	77	85·5	3·8	2·25
	39	435	802	367	82·1	78·1	81	85·5	3·4	1·47
October	40	432	856	424	83·4	79·0	79	85·5	2·1	·33
	41	419	791	372	84·0	78·5	74	85·6	1·6	·16
	42	414	737	323	83·5	77·4	72	85·6	2·1	·25
	43	433	721	288	83·6	76·7	69	85·8	2·2	·82
November	44	414	688	274	83·4	75·0	63	85·9	2·5	·02
	45	400	656	256	82·6	74·0	61	85·8	3·2	·30
	46	398	669	271	82·1	74·3	64	85·9	3·8	·07
	47	406	683	277	80·0	71·0	60	85·9	5·9	·03
December	48	403	697	294	79·7	72·1	65	85·7	6·0	—
	49	411	812	401	80·0	71·8	65	85·7	5·7	—
	50	410	928	518	78·8	70·2	62	85·4	6·6	—
	51	429	1,916	587	78·0	68·8	57	85·2	7·2	—
	52	431	1,223	792	76·7	68·5	61	85·0	8·3	—
		459	1,026	567	80·1	74·6	72	86·5	5·4	72·33

DIAGRAMS, SHEWING BY CURVES THE MEAN WEEKLY RESULTS OF THE FIGURES OF THE TABLE ANNEXED.

Attached to Dr Buchan's note.



APPENDIX No. LIX.

PARTICULARS REGARDING INOCULATIONS AND PLAGUE ATTACKS IN THE UMARKHADI JAIL, BOMBAY.

A.

NOMINAL ROLL and PARTICULARS of PRISONERS in the COMMON PRISON, BOMBAY, who were inoculated, and also those attacked with PLAGUE during the outbreak in that prison in 1897 and 1898.

Register No.	Names.	Age.	Date received into Jail.	Date of Inoculation.	Date of Discharge from Jail.	Date of Attack.	Result.
				1898.			
3	Heera Jiwa - - - 6022	45	4.5.97	1st Jan.	9.4.98		
5	Ratansey Dewroo - - - 6224	22	5.6.97	„	11.2.98		
6	Abdulla Ghorey - - - 6250	28	9.6.97	„	8.1.98		
16	Sadu Sauwar - - - - 6610	45	20.7.97	„			
17	Yedu Appa - - - - 6611	33	20.7.97	„			
18	Guljar Ajmeri - - - 6612	43	20.7.97	„			
19	Govind Bawa Gosain - - 6613	40	20.7.97	„	8.11.98		
21	Genu Gopala - - - 6615	32	20.7.97	„	13.6.98		
23	Tulsia Khandu - - 6618	32	20.7.97	„	16.2.99		
26	Bhan Sida - - - - 6695	30	29.7.97	„	28.4.98		
27	Domingo Fernandez - - 6708	40	31.7.97	„	29.1.98		
29	Mangal Khan Karimulla - 6758	40	6.8.97	„	5.1.98		
31	Waman Sadasir - - 6784	35	9.8.97	„	8.1.98		
34	Sk. Md. Ameen - - 6873	28	18.8.97	„	17.2.98		
37	Purushotam Khushal - - 6991	30	31.8.97	„	28.2.98		
38	Bhika Rama - - - - 7010	25	1.9.97	„	28.2.98		
39	Ruben Benjamin - - 7020	30	2.9.97	„	1.3.98		
40	Md. Buden - - - - 7021	28	2.9.97	„	1.3.98		
41	Sherdal Sabgul - - 7034	28	3.9.97	„	2.1.98		
45	Laxuman Balkishan - - 7112	25	15.9.97	„	14.3.98		
46	Rangia Gopal - - 7142	23	20.9.97	„	19.3.98		
48	Khatar Laxuman - - - 7146	40	21.9.97	„	19.3.98		
49	Sk. Md. Usman - - 7147	35	21.9.97	„	19.3.98		
51	Francis Marian - - - 7155	40	21.9.97	„	19.3.98		
53	Tukaram Sakharam - - 7180	23	23.9.97	„	22.3.98		
54	Abdul Karim - - - - 7206	26	24.9.97	„	22.1.98		
56	Bachee Sk. Khajoo - - 7233	32	27.9.97	„	26.1.98		
58	Husein Koudaji - - - 7252	25	29.9.27	„	28.1.98		
60	Sheoram Punaji - - 7258	26	30.9.97	„	29.3.98		
61	Laxuman Raghu - - - 7259	23	30.9.97	„	29.3.98		
62	Mohanlal Mulchaud - - 7275	18	2.10.97	„	1.4.98	18.3.98	Had been 168 days in jail when attacked. Recovered, and was released cured on 1.4.98.
68	Hanmanta Chandrin - - 7298	22	4.10.97	„	3.2.98		
69	Laxuman Mahadu - - - 7299	33	4.10.97	„	3.6.98		
72	Fakir Merwangi - - - 7316	30	6.10.97	„	5.3.98		
79	Deen Md. - - - - 7857	32	11.10.97	„	10.1.98		
81	Konda Manaji - - - 7359	26	11.10.97	„	10.2.98		
85	Heera Laxuman - - 7373	25	13.10.97	„	12.1.98		
87	Bheewa Hamanta - - 7375	22	13.10.97	„	12.2.98		
88	Laxuman Sewji - - 7376	35	13.10.97	„	12.2.98		
89	Nurkhan Husein Khan - 7377	27	13.10.97	„	11.7.98		
92	Suleman Sirdar - - 7392	45	15.10.97	„	14.4.98		
93	Joseph Antone - - 7393	25	15.10.97	„	14.7.98		
94	Balu Raoji - - - 7416	22	18.10.97	„	15.2.98		
95	Raoji Yenku - - - 7417	40	18.10.97	„	17.3.98		
102	Fatte Eshwar - - 7438	22	21.10.97	„	20.4.98		
103	Seena Govind - - - 7439	30	21.10.97	„	20.4.98		
105	Khemram Vallabram - - 7441	35	21.10.97	„	20.4.98		
107	Abdul Rahman - - 7455	30	22.10.97	„	21.1.98		
108	Sheobodin Gafur - - 7456	22	22.10.97	„	21.1.98		
109	Lawrence Lobo - - 7457	45	22.10.97	„	21.1.98		
110	Mansing Shikaram - - 7458	22	22.10.97	„	21.1.98		
111	Yacoob Ahmed - - 7481	30	25.10.97	„	24.2.98		
113	Bhiwa Vithu - - 7486	30	26.10.97	„	25.1.98		
114	Aharkam Aharlang - - 7487	40	26.10.97	„	25.4.98		
116	Laxumandas Kalyanji - 7498	32	27.10.97	„	19.4.98	10.2.98	Had been 107 days in jail when attacked. Recovered, and was released cured.
117	Samboo Yesu - - 7504	26	28.10.97	„	27.1.98		
121	Maney Hiuga - - - 7516	30	30.10 97	„	29.1.98		
122	Kasam Ebram - - - 7517	35	30.10.97	„	29.4.98		
125	Nagarchan l Jeibhovan - 7527	22	1.11.97	„	30.6.98		
126	Ganu Rama - - - 7530	35	20.11.97	„	1.3.98		
129	Waman Sitaram - - - 7541	25	2.11.97	„	1.3 98		
130	Seetal Vory - - - 7542	22	2.11.97	„	30.4.98	28.2.98	Had been 119 days in jail when attacked. Recovered, and was released cured.
131	Haji Abdul Husein Zand - 7543	35	21.1.97	„	30.4.98		
133	Hari Tul-iram - - 7549	25	3.11.97	„	2.2.98		
137	Laxuman Manohar - - 7559	35	5.11.97	„	4.1.98		
139	Rama Pandu - - - 7561	25	5.11.97	„	4.3.98		
141	Gopal Sunderji - - - 7563	30	5.11.97	„	4.7.98		
142	Bhima Kesha - - - 7569	30	6.11.97	„	28.1.98		
143	Sakharam Vithu - - 7570	28	6.11.97	„	4.2.98		
144	Malji Janu - - - 7571	40	6.11.97	„	5.5.98		
145	Booken Narayan - - - 7578	22	8.11.97	„	7.1.98		
146	Bala Manaji - - 7580	25	8.11.97	„	7.2.98		
155	Ranjoo Khanusa - - - 7597	45	9.11.97	„	7.5.98		
157	Gaji Khan Noorkhan - - 7604	45	10.11.97	„	9.2.98		
159	Frank Marine - - - 7606	25	10.11.97	„	9.5.98		
160	Ganu Nabaji - - - - 7607	30	10.11.97	„	9.5.98		
161	Achana Narsoo - - 7614	20	11.11.97	„	10.2.98		

Register No.	Names.		Age.	Date received into Jail.	Date of Inoculation.	Date of Discharge from Jail.	Date of Attack.	Result.
					1898.			
164	Sk. Husein Yacoob	7618	25	12.11.97	1st Jan.	11.2.98		
165	Md. Khan Husein Khan	7619	50	12.11.97	,,	11.2.98		
167	Daood Husein	7621	35	12.11.97	,,	11.2.98		
168	Deen Md. Lati	7622	25	12.11.97	,,	11.5.98		
170	Liana Dias	7633	35	13.11.97	,,	12.1.98		
171	Sheoram Govind	7634	22	13.11.97	,,	12.2.98		
172	Deoji Sadu	7635	25	13.11.97	,,	12.2.98		
175	Ebram Enoo	7646	20	15.11.97	,,	14.3.98		
178	Madarbux Juman	7656	26	16.11.97	,,	15.2.98		
179	Sk. Ahmed Haji Abdulla	7657	28	16.11.97	,,	15.2.98		
180	Joseph Antone	7658	18	16.11.97	,,	14.5.98		
182	Fatma Sakina	7661	35	17.11.97	,,	15.1.98		
184	Mego Ladanji	7669	39	17.11.97	,,	16.5.98		
185	Hansa Hama	7676	20	18.11.97	,,	17.3.98		
191	Nathia Kundlik	7713	24	23.11.97	,,	22.1.98		
192	Azib Md.	7714	35	23.11.97	,,	31.3.98		
195	Gunaji Sanjabu	7721	45	24.11.97	,,	23.3.98		
196	Bhiwa Vethu	7727	28	25.11.97	,,	29.10.98		
197	Laxuman Yesu	7728	20	25.11.97	,,	24.2.98		
198	Jangoo Yellu	7732	22	26.11.97	,,	25.1.98		
201	Yacoob Ahmed	7735	22	26.11.97	,,	25.3.98		
203	Gulam Dost Md.	7737	30	26.11.97	,,	31.3.98		
204	Reishwarao Hanmantrao	7738	23	26.11.97	,,	16.5.98		
210	Daya Rama	7752	30	29.11.97	,,	19.4.98		
211	Vithu Sidu	7753	30	29.11.97	,,	28.7.98		
212	Panda Ramji	7803	22	30.11.97	,,	28.2.98		
217	Khudabux Alibux	7826	18	3.12.97	,,	2.3.98		
218	Ahmed Md.	7827	35	3.12.97	,,	2.3.98		
221	Sk. Baban Balla	7832	18	3.12.97	,,	2.3.98		
222	Sk. Mohidin Sk. Adam	7833	18	3.12.97	,,	2.3.98		
223	Sk. Husein Sd. Alli	7834	30	3.12.97	,,	2.3.98		
224	Ganpat Nagu	7835	25	3.12.97	,,	2.6.98		
227	Daji Laxuman	7851	27	6.12.97	,,	5.1.98		
231	Withu Govind	7855	25	6.12.97	,,	5.4.98		
234	Rama Manaji	7864	23	7.12.97	,,	5.3.98		
235	Bhoomaya Malu	7865	28	7.12.97	,,	6.6.98		
239	Naveoji Shapurji	7877	30	8.12.97	,,	7.4.98		
240	Dhanji bhoy Naveoji	7878	28	8.12.97	,,	7.6.98		
243	Haji Abdul Rahman	7881	25	8.12.97	,,	7.9.93		
244	Elahi Amiron	7894	40	9.12.97	,,	19.1.98		
246	Kamla Pandu	7897	22	10.12.97	,,	9.6.98		
247	Laxuman Baboo	7898	20	10.12.97	,,	9.6.98		
248	Bheewa Kishna	7899	35	10.12.97	,,	9.6.98		
249	Bechar Lakha	7904	25	11.12.97	,,	9.4.98		
252	Antone Fernandez	7911	25	13.12.97	,,	24.1.98		
253	Abdul Razak Karimbux	7912	22	13.12.97	,,	12.2.98		
254	Deoji Kerson	7913	26	13.12.97	,,	12.4.98		
255	Clumilal Atmaram	7914	25	13.12.97	,,	12.4.98		
256	Nanabhai Thakurdas	7915	25	13.12.97	,,	12.4.98		
258	Madan Mohan	7919	35	13.12.97	,,	12.5.98		
260	Pandurang Keshow	7921	25	13.12.97	,,	12.6.98		
262	Sk. Md. Imambux	7924	40	14.12.97	,,	13.1.98		
263	Sakharam Bhikaji	7925	25	14.12.97	,,	13.1.98		
271	Sada Babaji	7937	22	16.12.97	,,	15.2.98		
272	Arjan Ganu	7939	30	16.12.97	,,	26.1.98		
274	Bala Keru	7940	30	16.12.97	,,	5.1.98		
276	Fakir Pandu	7943	30	17.12.97	,,	16.7.98		
277	Heera Ramji	7948	50	18.12.97	,,	16*4.98		
284	Vishnu Nagesh	7960	20	20.12.97	,,	19.2.98		
286	Vishnu Parashram	7962	35	20.12.97	,,	19.3.98		
290	Comer Jan Md.	7970	36	21.12.97	,,	20.1.98		
291	Suleman Khanusa	7971	30	21.12.97	,,	20.1.98		
292	Ismail Md.	7972	30	21.12.97	,,	20.1.98		
293	Bhagia Fakir	7973	25	21.12.97	,,	19.2.98		
295	Rama Babaji	7975	24	21.12.97	,,	20.4.98		
296	Ramjan Jaman	7976	25	21.12.97	,,	20.6.98		
300	Raghu Rama	7983	30	23.12.97	,,	22.6.98		
302	Sita, daughter of Heera	7985	30	23.12.97	,,	22.3.98		
301	Kundlik Balu	7987	40	23.12.97	,,	16.5.98		
304	Noor Md. Vazir Md.	7988	37	24.12.97	,,	23.2 98		
305	Vitnak Sermack	7989	20	24.12.97	,,	23.3.98		
307	Babaji Harichand	7991	35	27.12.97	,,	3.1.98		
309	Husein Khan Jaferkhan	7993	30	27.12.97	,,	5.1.98		
310	Gulam Husein Abdul	7994	22	27.12.97	,,	10.1.98		
313	Sk. Md. Akal Md.	7997	22	27.12.97	,,	26.1.98		
314	Pandu Vithu	7998	35	27.12.97	,,	2.4.98		
315	Govind Laxuman	7999	35	27.12.97	,,	26.2.98		
317	Keshow Babaji	8001	30	27.12.97	,,	26.6.98		
318	Jiwaji Musaji	8002	26	27.12.97	,,	25.6.98		
319	Bhagia Ganpat	8003	30	27.12.97	,,	16.5.98		
320	Mashala	8004	30	27.12.97	,,	4.2.98		
321	Dharma Chodoo	8005	45	27.12.97	,,	26.1.98		
322	Dhondi Ganu	8007	25	28.12.97	,,	26.2.98		
323	Bhimaji Dhondiba	8008	28	28.12.97	,,	26.3.98		
324	Naboo Gulam H.	8009	25	28.12.97	,,	26.3.98		
325	Bhimi Woman	8010	60	28 12.97	,,	12.3.98		
330	Maruti Baboo	8015	40	29.12.97	,,	4.1.98		
332	Baldeo Dearlal	8017	20	29.12.97	,,	4.1.98		
335	Rama Tukaram	8020	30	29.12.97	,,	18.1.98		

Register No.	Names.	Age.	Date received into Jail.	Date of Inoculation.	Date of Discharge from Jail.	Date of Attack.	Result.
				1898.			
336	Howdi Ramchandra - - 8021	50	29.12.97	1st Jan.	4.1.98		
340	Louis Dias - - - 8025	25	30.12.97	„	2[illegible].1.98		
341	Sk. Abdul Rahman Sk. R. - 8026	32	30.12.97	„	12.2.98		
342	Md. Gulamali - - - 8027	27	30.12.97	„	12.2.98		
343	Nathu Rama - - - 8028	22	30.12.97	„	28.2.98		
344	Dhondu Laxuman - - 8029	30	30.12.97	„	28.2.98		
345	Soorga Mogha - - - 8030	25	30.12.97	„	29.4.98		
346	Noor Md. Gafoor - - 8031	27	30.12.97	„	13.6.98		
350	Pitni Badal - - 8036	30	31.12.97	„	6.1.98		
351	Mata Badal Sheoram - - 8037	30	31.12.97	„	6.1.98		
353	Gaya Parshad - - 8039	35	31.12.97	„	6.1.98		
354	Premdas Soorju - - 8040	30	31.12.97	„	6.1.98		
358	Bombaysha Gujarska - - 8044	35	31.12.97	„	6.1.98		
359	Madu Tenubuk - - 8045	30	31.12.97	„	6.1.98		
360	Kishna Anaji - - - 8046	50	31.12.97	„	6.1.98		
363	Ramparshad Ramotai - - 8049	40	31.12.97	„	6.1.98		
364	Narayandas Mukundas - - 8050	30	31.12.97	„	6.1.98		
366	Md. Sukar - - - 8052	22	31.12.97	„	6.1.98		
368	Miya Baba - - - 8054	20	31.12.97	„	14.1.98		
370	Sk. Ebrahim Sk. Husein - - 8056	29	31.12.97	„	28.2.98		
371	Mustafa Jafer - - - 8057	30	31.12.97	„	30.6.98		
373	Gangabai, wife of Bapu -	50	31.12.97	„	6.1.98		
375	Ladi, wife of Laxuman - 8061	30	31.12.97	„	6.1.98		
378	Abar, wife of Dhondu - 8064	40	31.12.97	„	6.1.98		
1614	Kalia Mahadu - - -	25	10.6.98	4th July	9.8.98	29.7.98	Had been 49 days in jail when attacked. Recovered.
	UNDER TRIAL PRISONERS.			1898.			
2	Suleman Jamal - - -	30	30.11.97	1st Jan.	20.4.98		
3	Ismail Baker Khan - - - -	35	2.12.97	„	20.4.98		
8	Jessa Hukmaji - - -	30	23.12.97	„	4.1.98		
10	Md. Kaiser Khan - -	35	29.12.97	„	21.1.98		
11	Chedi Khan Sujat Khan - -	30	31.12.97	„	25.1.98		
13	Balvant Dhondu - - -	30	31.12.97	„	13.1.98		
15	Rama Govind - - -	28	31.12.97	„	6.1.98		
16	Yashwant Darku - - -	28	31.12.97	„	8.1.98		
17	Bhajra Vithu - - -	26	31.12.97	„	8.1.98		
	Total 199 + 1 inoculated in July 1898.						
	NON-INOCULATED PRISONERS WHO SUFFERED FROM PLAGUE.			Number of Days in Prison when attacked.			
151	Maulabux Rahimbux - -	20	8.11.97	23	1.1.98	31.12.97	Died 1.1.98.
215	Arjan Raghu - - -	26	2.12.97	29	6.1.98	31.12.97	Died 6.1.98.
13	Budha Haunsa - - -	48	20.7.97	164	4.1.98	1.1.98	Died 4.1.98.
401	Jetha Nursey - - -	40	4.1.98	3	2.5.98	7.1.98	Recovered.
522	Bhagubai - - - -	65	14.1.98	1	3.2.98	15.1.98	Recovered.
186	Ramjan Elahibux - -	25	19.11.97	59	22.1.98	17.1.98	Died 22.1.98.
147	Sadu Rama - - - -	22	8.11.97	70	7.3.98	18.1.98	Recovered.
33	Sk. Husein Sk. Baban - -	20	18.8.97	120	20.1.98	[illegible].1.98	Died 20.1.98.
65	Govind Rama - - -	20	4.10.97	107	3.2.98	20.1.98	Recovered.
163	Bhow Sakharam - - -	28	11.11.97	70	10.5.98	20.1.98	Recovered.
39	Limba Babaji - - -	25	4.1.98	18	24.1.98	22.1.98	Died 24.1.98.
35	Maruti Babaji - - -	25	23.8.97	153	26.1.98	24.1.98	Died 26.1.98.
283	Karim Khan Ajamkhan - -	32	20.12.97	36	27.1.98	24.1.98	Died 27.1.98.
104	Girdhar Motiram - - -	30	21.10.97	101	3.2.98	30.1.98	Died 3.2.98.
278	Andrew Meuse - - -	20	18.12.97	47	17.6.98	2.2.98	Recovered.
1705	Md. Ahmedkhan - - -	35	23.6.98	5	21.7.98	29.6.98	Recovered.

The number of dead rats or sick rats found during the attack was quite inappreciable. I should say that not more than half a dozen in all; one thing, however, is, I think, noteworthy, and that is, that as the plague increased in virulence in the Prison surroundings, the number of rats decreased, and *vice versâ*, and at the recrudescence of the plague they disappeared altogether, not a rat was to be seen for weeks, but about three months ago they commenced to return, and now the Prison is simply surrounded with them.

B.

DATES of DISCHARGE from the COMMON PRISON, BOMBAY, of PRISONERS INOCULATED in JANUARY 1898.

Dates.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1898.																
January -	–	–	1	5	4	13	1	4	–	2	–	2	3	2	1	–
February	–	1	1	2	–	–	1	–	1	1	4	8	–	–	4	–
March -	4	6	–	1	2	–	–	–	–	–	–	–	–	2	–	–
April -	1	1	–	–	1	–	1	–	2	–	–	3	–	1	–	1
May -	1	–	–	–	1	–	1	–	2	–	1	1	–	1	–	2
June -	1	1	1	–	–	2	1	–	3	–	1	–	2	–	–	–
July -	–	–	–	1	–	–	–	–	–	–	1	–	–	1	–	1
August -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
October -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
November	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
December	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

continued.

Dates.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total.
1898.																
January -	–	1	1	3	5	3	–	1	3	4	1	3	3	–	–	66
February	1	–	2	–	–	–	1	2	–	1	1	5	–	–	–	36
March -	2	–	5	–	–	2	2	–	1	2	–	–	2	–	–	31
April -	–	–	1	6	–	–	–	–	1	–	–	–	2	2	–	23
May -	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	12
June -	–	–	–	1	–	1	–	–	1	1	–	–	–	1	–	17
July -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
August -	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
September	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	3
October -	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
November	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
December	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total 195 (+ 4 prisoners not discharged).

DATES of DISCHARGE from the COMMON PRISON of NON-INOCULATED PRISONERS in JAIL during the INOCULATION of JANUARY 1898.

Dates.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1898.																
January -	7	–	6	11	4	20	1	4	–	2	1	1	1	4	2	–
February	–	1	5	1	3	–	3	1	2	1	1	2	–	1	–	–
March -	–	2	1	–	–	1	1	–	–	2	–	2	–	–	–	1
April -	–	–	–	2	3	–	–	–	–	–	–	–	1	1	–	1
May -	–	–	–	–	1	–	1	1	–	1	–	2	–	3	–	8
June -	–	–	–	–	–	2	2	–	1	2	–	–	3	–	–	–
July -	–	–	1	–	4	–	–	–	–	–	–	–	–	–	–	–
August -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
October -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
November	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
December	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

continued.

Dates.	17.	18.	19	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total.
1898.																
January	–	–	2	1	3	3	–	–	2	4	1	2	2	–	1	85
February	–	–	5	–	–	–	1	–	–	1	–	–	–	–	–	28
March -	–	1	5	–	1	–	2	1	–	–	–	2	2	–	2	26
April -	–	1	2	1	–	–	–	–	–	2	1	–	–	–	–	15
May -	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	19
June -	1	–	–	1	–	–	–	–	–	1	–	–	–	1	–	14
July -	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	6
August -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
October -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
November	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	2
December	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total 195 (+ 5 not discharged).

A. G. MACKENZIE,
Superintendent H.M.'s Common Prison,
Bombay.

APPENDIX No. LX.

STATISTICS

CONCERNING

PRISONERS

IN THE

HOUSE OF CORRECTION, BYCULLA,

DURING THE

PLAGUE OUTBREAKS

OF 1897 AND 1898.

APPENDIX No. LX.

STATISTICS concerning PRISONERS in the HOUSE OF CORRECTION, BYCULLA, during the PLAGUE OUTBREAKS of 1897 and 1898.

A.

LIST of NATIVE PRISONERS in the HOUSE of CORRECTION on the 30th January 1897, showing the Date of INOCULATION and PARTICULARS regarding PLAGUE

Serial No	Registration No.	Name.	Caste.	Age.	Date of Admission into the Prison.	Date of *Discharge* from the Prison.	Date of Inoculation.	Date Attacked by Plague.	Date of Recovery.	Date of Death.	Remarks.
1	1	Moru Bin Balkudas	Hindu	35	12 May 1886	22 June 1897	—	—	—	—	
2	98	Mahadu *Bin Nargapa*	,,	30	30 April 1894	12 Nov. ,,	—	—	—	—	
3	210	Abdulla Binder	Muhammadan	40	19 Sept. ,,	26 Mar. ,,	—	—	—	—	Sent to Ratnagiri.
4	265	Dewju Mahadu *alias* Rama Chandra	Hindu	28	22 Nov. ,,	20 ,, ,,	30 Jan. 1897	—	—	—	
5	352	Shiva Anarji	,,	40	16 Jan. 1895	26 ,, ,,	30 ,, ,,	—	—	—	
6	432	Hanmanta Narsoo	,,	39	18 Mar. ,,	17 July ,,	—	—	—	—	
7	494	Dhurma Tannoo	,,	36	1 May ,,	15 May ,,	30 Jan. 1897	—	—	—	
8	496	Esmail Hossein	Muhammadan	31	1 ,, ,,	20 July 1896	—	—	—	—	
					23 July 1896						
9	513	Luxuman Harry	Hindu	26	16 May 1895	21 Feb. 1898	—	—	—	—	
10	514	Kassim Hossein	Muhammadan	28	16 ,, ,,	24 Mar. 1897	30 Jan. 1897	—	—	—	
							2 Feb. ,,				
11	515	Muhomed Muda Khan	,,	24	16 ,, ,,	22 ,, ,,	—	—	—	—	
12	534	Jani Abraham, &c.	Jew	28	31 ,, ,,	8 April ,,	30 Jan. 1897	—	—	—	
							2 Feb. ,,				
13	570	Mool Chand Oosaagu	Hindu	28	27 June ,,	19 Mar. ,,	—	—	—	—	Transferred to Ratnagiri Prison.
14	582	Govind Waman *alias* Gobin, &c.	Muhammadan	32	8 July ,,	28 May ,,	—	—	—	—	
15	591	Mansark Bachoo	,,	34	13 ,, ,,	22 June ,,	30 Jan. 1897	—	—	—	
16	594	Gessu Hariju	Hindu	50	13 ,, ,,	26 Mar. ,,	—	—	—	—	
17	598	Rama Govind, &c.	,,	24	19 ,, ,,	29 May ,,	30 Jan. 1897	—	—	—	
18	599	Ram Chunder Rugbir	,,	25	19 ,, ,,	27 April 1898	—	—	—	—	
19	608	Vithul Narayen	,,	30	29 ,, ,,	8 June 1897	30 Jan. 1897	—	—	—	
20	622	Mariam Francis, &c.	R. Catholic, Christian.	21	6 Aug. ,,	13 Sept. ,,	—	—	—	—	
21	624	Hurry Gajaba	Hindu	40	8 ,, ,,	26 Mar. ,,	—	—	—	—	Transferred to Ratnagiri.
22	657	Ramdyal Khandhai, &c.	,,	35	9 ,, ,,	24 June ,,	30 Jan. 1897	—	—	—	
23	669	Janki Gujadhur	,,	23	15 ,, ,,	30 ,, ,,	—	—	—	—	
24	672	Keshav Umishankar	,,	24	16 ,, ,,	—	30 Jan. 1897	1 Feb. 1897	—	5 Feb. 1897	Bubonic plague.
25	677	Bechar Asha, &c.	,,	38	19 ,, ,,	28 June 1897	—	—	—	—	
26	694	Soonoo Luxman	,,	35	17 Sept. ,,	27 July ,,	30 Jan. 1897	—	—	—	
27	700	Dhondi Kendiba, &c.	,,	30	23 ,, ,,	9 Aug. ,,	—	—	—	—	
28	705	Kerwan Sidaju Wn. Mama	,,	42	26 ,, ,,	22 June ,,	30 Jan. ,,	—	—	—	
29	706	Bawaji Rugiju	,,	22	26 ,, ,,	22 ,, ,,	—	—	—	—	
30	707	Lukshman Pandu	,,	30	26 ,, ,,	18 Aug. ,,	—	—	—	—	
31	708	Abdul Karim Buksh	Muhammadan	22	26 ,, ,,	12 Mar. ,,	—	—	—	—	
32	709	Budhim Shunwas	Hindu	25	26 ,, ,,	5 June ,,	—	—	—	—	
33	746	Gangu Dongersey	,,	50	2 Nov. ,,	—	—	6 Feb. 1897	—	7 Feb. 1897	Bubonic plague.
34	769	Rama Yenkuti	,,	24	21 ,, ,,	14 May 1897	30 Jan. 1897	—	—	—	Transferred to Ratnagiri Prison.
35	778	Santon Fernandez	R. Catholic, Christian.	25	29 ,, ,,	19 Mar. ,,	—	—	—	—	,, ,,
36	786	Ganesh Luxuman	Hindu	35	30 ,, ,,	19 ,, ,,	—	—	—	—	,, ,,
37	828	Mahomed Neosery	Muhammadan	32	12 Dec. ,,	—	30 Jan. 1897	—	—	—	Still in the prison.
							2 Feb. ,,				
38	832	Rama Lakshman	Hindu	25	12 ,, ,,	—	30 Jan. ,,	1 Feb. 1897	17 Feb. 1897	—	
39	838	Shaik Hossein Ahmed	Muhammadan	24	12 ,, ,,	27 April 1898	30 ,, ,,	—	—	—	

40	849	Ram Chandra Mahadeo	Hindu	24	13 Dec. 1895	26 Mar. 1897	30 Jan. 1897	—	—	—		Transferred to Ratnagiri Prison.
41	890	Bessesser Chirkut	„	28	14 Jan. 1896	—	—	—	—	—		Still in the prison.
42	891	Ramsurrup Gopali	„	30	14 „ „	—	—	—	—	—		
43	892	Jugdeo Gunesh	„	30	14 „ „	31 Jan. 1899	30 Jan. 1897	—	—	—		
44	899	Ahmed Ali Surrup Ali	Muhammadan	40	18 „ „	16 June 1897	30 Mar. „	—	—	—		
							2 Feb. „					
45	905	Tatya Hurri, &c.	Hindu	30	30 „ „	22 „ „	—	—	—	—		
46	945	Sitaram Yesju	„	30	4 Feb. „	26 Mar. „	—	—	—	—		Transferred to Ratnagiri Prison.
47	946	Luchman Narayen Jodraj	„	32	4 „ „	22 June „	30 Jan. 1897	—	—	—		
48	974	Abdool Rahman	Muhammadan	55	26 „ „	22 „ „	30 „ „	—	—	—		
49	978	Bhima *alias* Kutappa Gungappa	Hindu	25	26 „ „	19 Mar. „	—	—	—	—		„ „
50	979	Kasna Kamlu	„	20	26 „ „	19 „ „	—	—	—	—		„ „
51	980	Baladin Subhai	„	25	26 „ „	22 June „	—	—	—	—		
52	981	Rama Lukappa	„	30	26 „ „	22 „ „	—	—	—	—		
53	982	Doolaji Dhensoo	„	29	26 „ „	—	—	—	—	—		Still in prison.
54	983	Sheik Ismail Khudabux	Muhammadan	46	26 „ „	22 June 1897	—	—	—	—		
55	984	Genoo Vithu	Hindu	21	26 „ „	25 Mar. „	30 Jan. „	—	—	—		
*56	*988	Mahomed Hossein	Muhammadan	30	27 „ „	—	30 „ „	4 Feb. 1897	—	8 Feb. 1897		Bubonic plague.
57	992	Tookaram Gopul	Hindu	28	2 Mar. „	26 Mar. 1897	30 „ „	—	—	—		Sent to Ratnagiri.
58	993	Mamu Ibrahim	Muhammadan	32	2 „ „	27 Aug. „	—	7 Feb. 1897	15 Mar. 1897	—		
59	1,002	Pestonjee Kowasjee	Parsee	50	9 „ „	19 Oct. „	30 Jan. 1897	—	—	—		
							2 Feb. „					
60	1,004	Vishnu Tatia	Hindu	25	9 „ „	26 Mar. „	30 Jan. „	—	—	—		„ „
							2 Feb. „					
61	1,006	Gunesh Shunker Dravid	„	27	9 „ „	6 Sept. „	30 Jan. „	—	—	—		Transferred to Yerowda Jail.
							2 Feb. „					
62	1,020	Ram Chunder Narayen, &c.	„	23	17 „ „	26 Mar. „	30 Jan. „	—	—	—		„ Ratnagiri Prison.
							2 Feb. „					
63	1,022	Ibrahim Mahomed Ali, &c.	Muhammadan	28	19 „ „	26 Feb. „	30 „ „	—	—	—		
64	1,023	Abdool Karim	„	22	20 „ „	14 May „	30 „ „	—	—	—		„ „
65	1,026	Mohideen Mahomed	„	25	25 „ „	27 Feb. „	30 „ „	—	—	—		
							2 Feb. „					
66	1,030	Ali Oomer	„	55	30 „ „	6 May 1898	—	—	—	—		
67	1,033	Abdoola Aladin	„	30	31 „ „	12 Feb. „	30 Jan. 1897	—	—	—		
68	1,034	Bhugoo Nabibux	„	38	31 „ „	19 Mar. 1897	30 „ „	—	—	—		„ „
							2 Feb. „					
69	1,040	Dhuna Radha	Hindu	40	5 April „	15 July „	—	—	—	—		
70	1,053	Jooman Kulloo	Muhammadan	35	9 „ „	19 Mar. „	—	—	—	—		„ „
71	1,054	Ahmed Ali Tyeb Ali	„	28	10 „ „	11 June „	30 Jan. 1897	—	—	—		
							2 Feb. „					
				40	10 „ „	6 Sept. „	30 Jan. „	—	—	—		
72	1,055	Eboo Baloo	„	25	14 „ „	11 June „	—	—	—	—		
73	1,061	Aboo Mahomed	„	32	14 „ „	25 Dec. „	30 Jan. 1897	—	—	—		
74	1,062	Hafiz Wazir Mirza Beg	„	50	21 „ „	25 Mar. „	—	—	—	—		
75	1,071	Esak Khuda Bux	„	25	25 „ „	13 Aug. „	—	—	—	—		
76	1,072	Raghunath Geswunt	Hindu	45	25 „ „	19 Mar. „	30 Jan. 1897	—	—	—		„ „
77	1,074	Paulos Augustin Fernandez	R. Catholic, Christian.	40	25 „ „	22 June „	30 „ „	—	—	—		
78	1,075	Sondia Hamr	Hindu	35	25 „ „	26 Mar. „	2 Feb. „	—	—	—		„ „
							30 Jan. „	—	—	—		
79	1,076	Keshow Lall Chota Lal, &c.	„	45	28 „ „	7 Aug. „	2 Feb. „	—	—	—		
80	1,077	Mahadu Bhicksett	„				—	—	—	—		

* Regarding this prisoner, *see* the correspondence published in Appendix No. LXXXVIII. below in this Volume.

LIST of NATIVE PRISONERS in the HOUSE OF CORRECTION, &c.—*continued.*

Serial No.	Registration No.	Name.	Caste.	Age.	Date of Admission into the Prison.	Date of *Discharge* from the Prison.	Date of Inoculation.	Date Attacked by Plague.	Date of Recovery.	Date of Death.	Remarks.
81	1,084	Abdul Rahim Khan	Muhammadan	18	29 April 1896	22 June 1897	30 Jan. 1897	—	—	—	
82	1,087	Cassim Ebrahim	,,	32	30 ,, ,,	3 April ,,	—	—	—	—	
83	1,091	Arjuna Balla	Hindu	25	4 May ,,	3 Feb. ,,	—	—	—	—	
84	1,092	Golam Hossein Taj Khan	Muhammadan	20	4 ,, ,,	10 April ,,	—	—	—	—	
85	1,093	Rama Govind, &c.	Hindu	22	5 ,, ,,	—	—	26 Jan. 1897	—	30 Jan. 1897	Bubonic plague.
86	1,094	Ramvalab Rampartab	,,	20	5 ,, ,,	10 April 1897	—	27 ,, ,,	17 Feb. 1897	—	
87	1,095	Ali Mahomed Tayab Ali	Muhammadan	18	5 ,, ,,	19 Mar. ,,	30 Jan. 1897 2 Feb. ,,	—	—	—	Transferred to Ratnagiri Prison.
88	1,097	Bablia Luxaman	Hindu	28	5 ,, ,,	19 ,, ,,	—	—	—	—	
89	1,100	Murad Gull Mahomed, &c.	Muhammadan	22	7 ,, ,,	6 Feb. ,,	30 Jan. 1897	—	—	—	
90	1,104	Kessoo Purshotum, &c.	Hindu	25	11 ,, ,,	27 April ,,	30 ,, ,,	—	—	—	
91	1,105	Kumoo Imam, &c.	Muhammadan	18	14 ,, ,,	23 ,, ,,	—	—	—	—	
92	1,106	Mahomed Abdullah, &c.	,,	16	14 ,, ,,	13 Mar. ,,	—	—	—	—	
93	1,107	Currim Hasan	,,	17	14 ,, ,,	13 ,, ,,	—	—	—	—	
94	1,108	Ramju Ahmed	,,	18	19 ,, ,,	24 April ,,	30 Jan. 1897 2 Feb. ,,	—	—	—	
95	1,110	Sadoo Mahadeo	Hindu	32	22 ,, ,,	27 ,, ,,	30 Jan. ,, 2 Feb. ,,	—	—	—	
96	1,114	Rama Khandu	,,	25	26 ,, ,,	1 May ,,	30 Jan. ,, 2 Feb. ,,	—	—	—	
97	1,116	Khrishna Bhugnak	,,	27	30 ,, ,,	27 Feb. ,,	30 Jan. ,,	—	—	—	
98	1,117	Burapa Tolapa, &c.	,,	30	30 ,, ,,	5 May ,,	30 ,, ,,	—	—	—	
99	1,118	Fazal Kasam, &c.	Muhammadan	21	1 June ,,	13 ,, ,,	—	—	—	—	
100	1,119	Vithu Rama	Hindu	28	1 ,, ,,	7 ,, ,,	—	—	—	—	
101	1,123	Kallan Himat Khan	Muhammadan	30	5 ,, ,,	29 ,, ,,	—	—	—	—	
102	1,124	Abba Tookaram	Hindu	22	5 ,, ,,	14 ,, ,,	—	—	—	—	Transferred to Ratnagiri Prison.
103	1,128	Abdul Illahi Bux, &c.	Muhammadan	23	8 ,, ,,	14 ,, ,,	30 Jan. 1897	—	—	—	
104	1,129	Raoji Jothu Powar	Hindu	25	8 ,, ,,	—	—	30 Jan. 1897	—	1 Feb. 1897	Bubonic plague.
105	1,130	Mahomed Kasim Nur Mahomed	Muhammadan	28	9 ,, ,,	26 Mar. 1897	30 Jan. 1897 2 Feb. ,,	—	—	—	Transferred to Ratnagiri Prison.
106	1,131	Deo Vithoo	Hindu	42	9 ,, ,,	18 May ,,	—	—	—	—	
107	1,132	Maruti Babaji	,,	30	9 ,, ,,	19 Aug. ,,	—	—	—	—	
108	1,133	Sahibdin Fakir	Muhammadan	28	9 ,, ,,	8 Mar. ,,	30 Jan. 1897	—	—	—	
109	1,136	Mawji Bhowan	Hindu	27	10 ,, ,,	9 ,, ,,	—	5 Feb. 1897	12 Feb. 1897	—	
110	1,137	Esoof Ali Jiwaji, &c.	Muhammadan	28	10 ,, ,,	19 ,, ,,	30 Jan. 1897	—	—	—	Transferred to Ratnagiri Prison.
111	1,138	Bhgoobhai Nihal Chand	Hindu	21	13 ,, ,,	19 ,, ,,	—	—	—	—	,, ,,
112	1,140	Mahomed Isak Mirza Sulleman	Muhammadan	50	16 ,, ,,	28 May ,,	—	—	—	—	
113	1,141	Kondi Balla	Hindu	48	18 ,, ,,	14 ,, ,,	30 Jan. 1897	—	—	—	,, ,,
114	1,142	Ramdyal Jardoo, &c.	,,	22	18 ,, ,,	17 Feb. ,,	30 ,, ,,	—	—	—	
115	1,143	Gungaram Mahadeo	,,	21	19 ,, ,,	14 May ,,	—	—	—	—	,, ,,
116	1,144	Jiva Vireband	,,	24	19 ,, ,,	19 Mar. ,,	—	30 Jan. 1897	17 Feb. 1897	—	,, ,,
117	1,147	Hari Shivchurn	,,	30	27 ,, ,,	26 ,, ,,	—	—	—	—	,, ,,
118	1,148	Girdhar Kullianji, &c.	,,	27	30 ,, ,,	27 Feb. ,,	—	—	—	—	
119	1,150	Fakira Pandoo	,,	25	1 July ,,	9 June ,,	30 Jan. 1897 2 Feb. ,,	—	—	—	
120	1,151	Juva Laxuman	,,	21	1 ,, ,,	26 Mar. ,,	—	—	—	—	,, ,,

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LIST of NATIVE PRISONERS in the HOUSE of CORRECTION, &c.—*continued.*

Serial No.	Registration No.	Name.	Caste.	Age.	Date of Admission into the Prison.	Date of *Discharge* from the Prison.	Date of Inoculation.	Date Attacked by Plague.	Date of Recovery.	Date of Death.	Remarks.
167	1,210	Dhondia Hiroo	Hindu	32	10 Aug. 1896	17 July 1897	30 Jan. 1897 2 Feb. „	—	—	—	Transferred to Ratnagiri Prison.
168	1,211	Rameshwar Bhayalal	„	30	11 „ „	19 Mar. „	—	—	—	—	
169	1,212	Domla Kika	„	32	12 „ „	22 June „	30 Jan. 1897	—	—	—	
170	1,213	Vasanji *alias* Vishram Kanji	„	28	14 „ „	14 May „	30 „ „ 2 Feb. „	—	—	—	„ „
171	1,214	Sowlia Luxaman	„	35	15 „ „	14 „ „	30 Jan. „ 2 Feb. „	—	—	—	
172	1,215	Sowlia Atmaram	„	25	20 „ „	19 „ „	—	—	—	—	
173	1,216	Vishram Lakhansey	„	23	20 „ „	19 „ „	—	—	—	—	
174	1,217	Ahmed Warin	Muhammadan	23	21 „ „	20 „ „	30 Jan. 1897	—	—	—	
175	1,218	Bhawoo Sadoba	Christian	22	22 „ „	26 „ „	—	—	—	—	
176	1,219	Nurmahomed Abdul Rahiman	Muhammadan	20	25 „ „	23 Mar. „	—	—	—	—	
177	1,220	Bhinji Gokul	Hindu	22	25 „ „	22 June „	—	—	—	—	
178	1,221	Dharsey Ramji	„	28	25 „ „	9 July 1898	—	—	—	—	
179	1,222	Govind Pandu	„	26	25 „ „	—	30 Jan. 1897	1 Feb. 1897	—	3 Feb. 1897	Bubonic plague.
180	1,223	Hassan Bachoo	Muhammadan	22	25 „ „	29 July 1897	30 „ „ 2 Feb. „	—	—	—	
181	1,224	Anna Vishnu	Hindu	23	25 „ „	22 June „	—	31 Jan. 1897	8 April 1897	—	
182	1,225	Maneck Chand Bhudan	„	50	26 „ „	2 July „	30 Jan. 1897 2 Feb. „	—	—	—	
183	1,227	Abdoola Alli	Muhammadan	30	28 „ „	11 „ 1898	—	—	—	—	
184	1,228	Mahomed Lal Khan	„	23	31 „ „	7 Aug. 1897	—	—	—	—	
185	1,229	Ganno Esso	Hindu	32	31 „ „	—	—	31 Jan. 1897	—	4 Feb. 1897	Bubonic fever.
186	4,230	Shaik Dugdoo Jan Mahomed	Muhammadan	30	31 „ „	14 July 1898	30 Jan. 1897 2 Feb. „	—	—	—	
187	1,231	Gangaram Lachram, &c.	Hindu	30	2 Sept. 1896	26 „ „	—	—	—	—	
188	1,232	Ismailji Tyebji	Muhammadan	26	3 „ „	14 „ „	30 Jan. 1897	—	—	—	
189	1,233	Haji Ismail Kazam	„	33	3 „ „	2 June 1897	—	—	—	—	
190	1,234	Abdulla Ebrahim	„	20	4 „ „	26 Mar. „	—	—	—	—	
191	1,235	Khatow Lakhmidas	Hindu	26	4 „ „	1 May „	—	27 Jan. 1897	10 Feb. 1897	—	Transferred to Ratnagiri Prison.
192	1,237	Mahomed Abdulla	Muhammadan	23	7 „ „	6 April „	30 Jan. 1897	—	—	—	
193	1,238	Babaji Sambhaji	Hindu	28	7 „ „	—	—	5 Feb. 1897	—	7 Feb. 1897	Bubonic plague.
194	1,239	Rahia Gunpat	„	35	8 „ „	—	—	—	—	12 Mar. 1898	Died in Jail hospital.
195	1,240	Sakaram Vithal	„	25	8 „ „	16 Mar. 1897	—	—	—	—	Transferred to Ratnagiri Prison.
196	1,242	Gannoo Baloo	„	24	10 „ „	—	—	27 Jan. 1897	—	31 Jan. 1897	Bubonic plague.
197	1,243	Nanya Ruthosa	„	25	12 „ „	24 Aug. 1897	38 Jan. 1897	—	—	—	
198	1,244	Luxman Mahadeo	„	29	12 „ „	10 June „	—	—	—	—	
199	1,245	Cassim Mahomed	Muhammadan	29	12 „ „	30 April 1898	—	—	—	—	
200	1,246	Oomerodeen Gaus Khan	„	22	13 „ „	11 June 1897	—	—	—	—	
201	1,247	Antone Salvadore	R. Catholic, Christian.	23	14 „ „	13 May „	—	27 Jan. 1897	17 Feb. 1897	—	
202	1,250	Sai Kallian, &c.	Hindu	48	17 „ „	13 Dec. „	—	—	—	—	
203	1,251	Mahadu Sadhu, &c.	„	40	18 „ „	19 Mar. „	30 Jan. 1897	—	—	—	Transferred to Ratnagiri Prison.
204	1,252	Jaymohan Ganesh	„	25	19 „ „	—	—	2 Feb. 1897	—	11 Feb. 1897	Bubonic fever.
205	1,253	Juan Baptist D'Souza	R. Catholic, Christian.	32	19 „ „	26 July 1897	—	—	—	—	

206	1,254	Ram Prasad Terva, &c.	Hindu	35	19 „ „	1 Oct. „	—	—	—	—		
207	1,255	Tanoo Ganoo	„	27	21 „ „	19 June „	30 Jan. 1897	—	—	—		
208	1,259	Dhakul Ramchunder	„	27	22 „ „	21 „ „	—	—	—	—		
209	1,260	Raghunath Narayen, &c.	„	18	23 „ „	19 Mar. „	—	—	—	—		Transferred to Ratnagiri Prison.
210	1,261	Kallu Bhima	„	35	24 „ „	12 Feb. „	—	1 Feb. 1897	—	12 Feb. 1897		Plague.
211	1,262	Sakharam Raghu	„	32	26 „ „	5 Aug. „	30 Jan. 1897 2 Feb. „	—	—	—		
212	1,267	Baloo Krishna	„	30	30 „ „	22 June „	—	6 Feb. 1897	15 Mar. 1897	—		
213	1,268	Keshowji Kavji	„	32	2 Oct. „	19 Mar. „	—	—	—	—		Transferred to Ratnagiri Prison.
214	1,269	Ghopal Bhicoo	„	25	2 „ „	31 May „	—	—	—	—		
215	1,270	Mahadeo Hari	„	27	2 „ „	31 „ „	—	—	—	—		
216	1,271	Soonoo Ganoo	„	25	2 „ „	12 Aug. 1898	30 Jan. 1897	—	—	—		
217	1,272	Balkrishna Mahadu	„	22	3 „ „	—	—	27 Jan. 1897	—	30 Jan. 1897		Bubonic plague.
218	1,273	Megju Kurmsey	„	52	2 „ „	—	—	—	—	16 June „		Dysentery.
219	1,274	Luxman Dhundu	„	28	3 „ „	15 Sept. 1897	30 Jan. 1897	—	—	—		
220	1,275	Bala Keshow	„	26	3 „ „	8 „ „	30 „ „	—	—	—		
221	1,276	Hossein Mahomed	Muhammadan	25	5 „ „	26 Mar. „	—	30 Jan. 1897	25 Feb. 1897	—		Transferred to Ratnagiri Prison.
222	1,277	Mahomed Bala	„	28	5 „ „	21 Aug. „	—	—	—	—		
223	1,278	Manuel Fernandez	R. Catholic, Christian.	49	5 „ „	—	30 Jan. 1897	—	—	26 July		Cholera.
224	1,278	Haji Moosa Dada	Muhammadan	36	6 „ „	5 June 1897	—	—	—	—		
225	1,280	Mahomed Jansen, &c.	„	28	6 „ „	4 Sept. „	30 Jan. 1897	—	—	—		
226	1,281	Mahomed Ebrahim	„	28	6 „ „	22 June „	—	—	—	—		
227	1,282	Dalsook Bhagoo	Hindu	29	6 „ „	12 Aug. „	—	—	—	—		
228	1,283	Nanabhoy Ananta	„	30	8 „ „	7 June „	—	—	—	—		
229	1,284	Mahomed Hossien Khan Duktukhan	Muhammadan	25	8 „ „	26 Mar. „	—	—	—	—		Transferred to Ratnagiri Prison.
230	1,285	Rowju Bhiwa, &c.	Hindu	30	14 „ „	19 „ „	—	—	—	—		„ „
231	1,286	Dowlatrao Khamo	„	22	15 „ „	20 Aug. „	—	—	—	—		
232	1,287	Sakharam Atmaram	„	37	16 „ „	15 June „	—	—	—	—		
233	1,289	Bhimsing Sileysing	„	36	17 „ „	23 Aug. „	30 Jan. 1897 2 Feb. „	—	—	—		
234	1,290	Haji Isoof	Muhammadan	34	19 „ „	26 Mar. „	—	—	—	—		Transferred to Ratnagiri Prison.
235	1,291	Fazel Dharsey	„	28	19 „ „	16 Oct. „	—	—	—	—		
236	1,294	Luxman Sakharam	Hindu	22	20 „ „	24 Aug. „	—	—	—	—		
237	1,295	Luxman Malloo	„	32	20 „ „	28 „ „	30 Jan 1897 2 Feb. „	—	—	—		
238	1,296	Kammoo Umer	Muhammadan	37	20 „ „	7 Sept. 1898	—	—	—	—		
239	1,297	Dhondu Sulkia	Hindu	32	20 „ „	17 Aug. 1897	—	6 Feb. 1897	25 Mar. 1897	—		Transferred to Yerowda Prison.
240	1,298	Syed Mahomed Kabais	Muhammadan	38	20 „ „	19 Mar. „	30 Jan. 1897 2 Feb. „	—	—	—		Transferred to Ratnagiri Prison.
241	1,999	Magan Tribhowan	Hindu	29	21 „ „	—	—	—	—	13 July 1897		Died in Jail hospital.
242	1,300	Golam Hossein Makon	Muhammadan	38	22 „ „	21 July 1897	—	—	—	—		
243	1,302	Golam Hussein Sharofati	„	50	24 „ „	23 June „	30 Jan. 1897	—	—	—		
244	1,303	Makhan Lala	Hindu	30	26 „ „	25 May „	30 „ „	—	—	—		
245	1,304	Gunpatti Babajee	„	28	27 „ „	2 Sept. „	30 „ „ 2 Feb „	—	—	—		
246	1,305	Fakir Isoof	Muhammadan	54	27 „ „	26 July „	—	—	—	—		
247	1,306	Mahadeo Ramjee	Hindu	32	28 „ „	4 Sept. „	30 Jan. 1897 2 Feb. „	—	—	—		
248	1,308	Jyebali Musabhai	Muhammadan	32	31 „ „	2 Sept. „	30 Jan. „ 2 Feb. „	—	—	—		
249	1,309	Jageshwar Saju	Hindu	45	2 Nov. „	—	—	—	—	—		Still in the prison.
250	1,310	Vishram Jairam	„	50	2 „ „	—	—	30 Jan. 1897	—	5 Feb. 1897		Bubonic plague.
251	1,311	Joseph Antone D'Souza	R. Catholic, Christian.	28	3 „ „	26 Mar. 1897	30 Jan. 1897	—	—	—		Transferred to Ratnagiri Prison.

App. IX.

LIST of NATIVE PRISONERS in the HOUSE OF CORRECTION, &c.—*continued.*

Serial No.	Registration No.	Name.	Caste.	Age.	Date of Admission into the Prison.	Date of *Discharge* from the Prison.	Date of Inoculation.	Date Attacked by Plague.	Date of Recovery.	Date of Death.	Remarks.
252	1,312	Walli Chand	Muhammadan	30	6 Nov. 1896	—	—	30 Jan. 1897	—	8 Feb. 1897	Bubonic plague.
253	1,313	Babajee Luximon	Hindu	32	6 „ „	23 Sept. 1898	—	—	—	—	
254	1,315	Kalloo Abdulla	Muhammadan	47	7 „ „	16 „ 1897	—	—	—	—	
255	1,316	Rama Deojee	Hindu	25	9 „ „	—	30 Jan. 1897	—	—	—	Still in the prison.
256	1,317	Dajee Tookaram	„	25	9 „ „	26 Mar. 1897	—	—	—	—	Transferred to Ratnagiri Prison.
257	1,318	Kasam Sileman	Muhammadan	32	9 „ „	19 „ „	30 Jan. 1897 2 Feb. „	—	—	—	„ „
258	1,319	Shaik Mahomed Nur Mahomed	„	40	9 „ „	26 „ „	30 Jan. „	—	—	—	„ „
259	1,320	Ebraim Hassan	„	35	10 „ „	9 July „	30 „ „	—	—	—	„ „
260	1,321	Antone Joseph Fernandez	R. Catholic, Christian.	23	10 „ „	19 Mar. „	—	—	—	—	„ „
261	1,323	Dhondu Dhurma, &c.	Hindu	40	12 „ „	29 Sept. 1898	30 Jan. 1897	—	—	—	
262	1,324	Abdul Kussum	Muhammadan	31	13 „ „	22 June 1897	—	—	—	—	
263	1,325	Abdul Karim	„	36	17 „ „	29 Nov. „	30 Jan. 1897	—	—	—	
264	1,326	Shakri Khan Ismail Khan	„	21	17 „ „	26 Mar. „	—	—	—	—	„ „
265	1,327	Marooti Sadu	Hindu	25	17 „ „	22 June „	—	—	—	—	
266	1,328	Shaik Abdulla Shaik Abas	Muhammadan	57	17 „ „	26 Mar. „	—	—	—	—	„ „
267	1,329	Mahadoo Dhondoo	Hindu	34	17 „ „	22 June „	—	—	—	—	
268	1,330	Pestonjee Sorabjee	Parsee	35	18 „ „	22 „ „	—	—	—	—	
269	1,331	Bhooria Sunder	Hindu	24	18 „ „	22 „ „	—	—	—	—	
270	1,332	Kalloo Luxman	„	26	18 „ „	5 Oct. 1898	—	6 Feb. 1897	17 Feb. 1897	—	
271	1,336	Ganput Babajee	„	26	19 „ „	26 Mar. 1897	30 Jan. 1897	2 „ „	10 „ „	—	
272	1,338	Shaik Mahomed Shaik Hussan, &c.	Muhammadan	33	23 „ „	22 Sept. 1898	—	—	—	—	
273	1,340	Nandoo Bandoo	Hindu	23	24 „ „	22 June 1897	—	—	—	—	
274	1,341	Narayen Ganoo	„	27	24 „ „	19 Mar. „	30 Jan. 1897 12 Feb. „	—	—	—	„ „
275	1,342	Narayen Magujee	„	30	24 „ „	22 June „	—	—	—	—	
276	1,343	Vachraj Mansing	„	25	24 „ „	19 Mar. „	—	—	—	—	„ „
277	1,344	Rama Noonjiajee	„	30	24 „ „	26 „ „	30 Jan. 1897	—	—	—	„ „
278	1,345	Sakaram Arjoon	„	22	24 „ „	19 „ „	30 „ „	—	—	—	„ „
279	1,346	Bhickin Pandoo	„	26	24 „ „	26 „ „	30 „ „	—	—	—	„ „
280	1,348	Abdul Rahman Karim	Muhammadan	35	26 „ „	14 May „	30 „ „ 2 Feb. „	—	—	—	„ „
281	1,349	Adamjee Alibhai	„	28	30 „ „	26 Mar. „	—	27 Jan. 1897	10 Feb. 1897	—	„ „
282	1,350	Vithu Mankia	Hindu	28	1 Dec. „	11 Oct. 1898	30 Jan. 1897	—	—	—	
283	1,351	Jhawar Jeja	Muhammadan	48	3 „ „	6 „ 1897	—	—	—	—	
284	1,352	Abbas Ally Ramzoo	„	28	4 „ „	19 Mar. „	—	—	—	—	„ „
285	1,353	Ali Shaik Mahomed	„	53	4 „ „	19 „ „	—	—	—	—	„ „
286	1,355	Kishan Manajee	Hindu	25	7 „ „	6 Aug. „	30 Jan. 1897	—	—	—	
287	1,356	Abdul Karim Golam Hussain	Muhammadan	38	8 „ „	—	30 „ „	1 Feb. 1897	—	8 Feb. 1897	Bubonic plague.
288	1,357	Mahadeojee Mamekchand	Hindu	23	8 „ „	26 Mar. 1897	—	—	—	—	Transferred to Ratnagiri Prison.
289	1,353	Shaik Ebraim Shaik Ally	Muhammadan	52	9 „ „	8 June „	30 Jan. 1897 2 Feb. „	—	—	—	
290	1,359	Narayen Dhondu	Hindu	25	9 „ „	—	—	27 Jan. 1897	—	30 Jan. 1897	Bubonic plague.
291	1,361	Karim Khan Rahiman Khan	Muhammadan	36	10 „ „	22 June „	—	—	—	—	
292	1,362	Syed Jonas Ali	„	27	10 „ „	22 „ „	—	30 Jan. 1897	15 Mar. 1897	—	
293	1,363	Juganath Mahanand	Hindu	39	10 „ „	8 Oct. 1898	30 Jan. 1897	—	—	—	

294	1,364	Tara Chand Dhossa	„	30	11 Dec.	„	26 Mar.	1897	—	—	—	—	—	—	Transferred to Ratnagiri Prison.
295	1,365	Mahomed Ismail	Muhammadan	35	11 „	„	26 „	„	30 Jan.	1897	—	—	—	—	„ „
296	1,366	Shamrao Sittaram	Hindu	27	12 „	„	14 May	„	30 „	„	7 Feb. 1897	16 Mar.	1897	—	„ „
									2 Feb.	„					
297	1,367	Abdoola Imam	Muhammadan	56	12 „	„	19 Mar.	„	—		—	—		—	„ „
298	1,368	Manji Khatao	Hindu	24	14 „	„	19 „	„	30 Jan.	1897	—	—		—	„ „
299	1,372	Deysey Nursey	„	24	15 „	„	26 „	„	30 „	„	—	—		—	„ „
300	1,373	Syed Nur Syed Takrudin, &c.	Muhammadan	56	16 „	„	14 Aug.	„	—		—	—		—	„ „
301	1,376	Pedro Pedar	R. Catholic, Christian.	25	17 „	„	19 Mar.	„	30 Jan.	1897	—	—		—	Transferred to Kolaba Lunatic Asylum.
302	1,377	Poodisingaya John Pereira	Budhist	22	18 „	„	17 „	„	—		—	—		—	
303	1,378	Jeysing Sewa	Hindu	32	18 „	„	—		30 Jan.	1897	—	—		—	Still in the prison.
304	1,379	Shivram Antajee	„	19	18 „	„	—		30 „	„	—	—		—	
305	1,380	Abdul Rahiman	Muhammadan	29	18 „	„	—		30 „	„	—	—		—	Sent to Hyderabad, Sind.
306	1,381	Hakim Abdulla	„	43	18 „	„	10 May	1898	30 „	„	—	—		—	Still in the prison.
307	1,382	Mowlabux Bahadur	„	30	18 „	„	—		30 „	„	—	—		—	Sent to Hyderabad, Sind.
308	1,383	Sitaram Bholuram	Hindu	35	18 „	„	10 May	1898	—		—	—		—	„ „
309	1,384	Killoo Kaloona	„	22	18 „	„	10 „	„	30 Jan.	1897	—	—		—	
310	1,385	Yacoob Samsher	Jew	35	18 „	„	26 Mar.	1897	30 „	„	—	—		—	
311	1,386	Luxman Narayen	Hindu	27	21 „	„	14 May	„	30 „	„	—	—		—	
312	1,387	Sadasew Khanderao	„	24	23 „	„	3 Sept.	1898	30 „	„	—	—		—	
313	1,388	Vithal Moghajee	„	32	24 „	„	26 Mar.	1897	—		—	—		—	Transferred to Ratnagiri Prison.
314	1,389	Dhanjee Mitha	Muhammadan	32	24 „	„	5 Sept.	1898	30 Jan.	1897	—	—		—	
									2 Feb.	„					„ „
315	1,390	Alli Manji	„	35	24 „	„	19 Mar.	1897	30 Jan.	„	—	—		—	
									2 Feb.	„					
316	1,398	Mahomed Badan Khan	„	23	2 Jan.	1897	1 Sept.	„	30 Jan.	„	—	—		—	
									2 Feb.	„					
317	1,399	Luxman Babu, &c.	Hindu	25	2 „	„	1 „	„	30 Jan.	„	—	—		—	
318	1,400	Sukdeo Jaigovind	„	30	2 „	„	26 Mar.	„	30 Jan.	„	—	—		—	
									2 Feb.	„					„ „
319	1,401	Ranchod Bhajee	„	33	2 „	„	1 July	„	30 Jan.	„	—	—		—	
									2 Feb.	„					
320	1,402	Narayen Marroo, &c.	„	27	4 „	„	3 Sept.	„	30 Jan.	„	—	—		—	
321	1,403	Mirkhan Yarkhan	Muhammadan	29	5 „	„	22 June	„	„	„	—	—		—	
322	1,404	Bhoka *alias* Hussain Alli	„	25	5 „	„	22 „	„	30 „	„	—	—		—	
323	1,405	Rama Govinda	Hindu	26	5 „	„	22 „	„	—		—	—		—	
324	1,406	Moossa Rakabhai	Muhammadan	25	5 „	„	22 „	„	—		—	—		—	
325	1,407	Muria Nagapa	Hindu	52	5 „	„	22 „	„	—		—	—		—	
326	1,408	Kessu Canna	„	32	5 „	„	22 „	„	—		—	—		—	
327	1,410	Motiram Makanjee	„	25	7 „	„	—		—		—	—		—	Still in the prison.
328	1,411	Isuf Dhakatia	Muhammadan	27	8 „	„	26 Mar.	1897	30 Jan.	1897	—	—		—	Transferred to Ratnagiri Prison.
329	1,412	Kalloo Padamsey	Hindu	33	9 „	„	26 Sept.	1898	30 „	„	—	—		—	
									2 Feb.	„					
330	1,413	Deechand Rowjee	„	35	9 „	„	26 Mar.	1897	30 Jan.	„	—	—		—	„ „
331	1,414	Harpal Singh Ratan Sing	„	36	9 „	„	19 „	„	30 „	„	—	—		—	„ „
									2 Feb.	„					
332	1,415	Ram Chandra Gopal	„	35	9 „	„	26 „	„	—		—	—		—	
333	1,416	Golam Mohidin Kamruddin	Muhammadan	29	18 „	„	1 Feb.	„	—		—	—		—	
334	1,417	Pomersey Coverjee	Hindu	25	26 „	„	8 Nov.	1898	—		—	—		—	
335	1,418	Dharshan Sing Raghunath Sing	„	35	27 „	„	26 July	1897	—		—	—		—	
336	1,420	Ram Surroop Hanumandeo	„	36	28 „	„	—		—		—	—		—	
337	1,421	Abas Abdoola	Muhammadan	45	29 „	„	14 May	1897	—		—	—	12 Feb.	1898	Died in Jail hospital.
338	976	Ashama Erasawmy	Hindu	25	26 Feb.	1896	3 Aug.	„	—		—	—		—	Transferred to Kolaba Lunatic Asylum.

The following 51 prisoners were inoculated a second time on the 2nd February, 1897:—Prisoners Nos. 534, 828, 1348, 1076, 1108, 1130, 1114, 1230, 1412, 1400, 1318, 1414, 1006, 1054, 1075, 1002, 1400, 1304, 1262, 1020, 1194, 1004, 1213, 1026, 1398, 1366, 1390, 1295, 1389, 1306, 1110, 1150, 1289, 1208, 1223, 1153, 1210, 1172, 1189, 514, 1341, 1358, 1214, 1166, 1225, 899, 1034, 1298, 1095, 1209, 1308.

App. IX.

INOCULATIONS with M. HAFFKINE'S PROPHYLACTIC SERUM in 1898: showing the reaction in each case inoculated in Her Majesty's House of Correction, Byculla, Bombay.

Serial No.	Prison Register No.	Names of Prisoners.	Date of Inoculation, 1st time.	Temperature, 3rd.		Temperature 4th.		Temperature, 5th.		Date of Inoculation, 2nd time.	Temperature 9th.		Temperature, 10th.		Temperature, 11th.		Remarks.	Date of leaving Jail.
			1898.	A.M	P.M.	A.M.	P.M.	A.M.	P.M.	1898.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		
1	213	Ganesh Shunkar Dravid	3rd Jan.	—	97·0	100·0	99·0	97·4	N.	9th Jan.	—	100·4	100·8	99·0	98·2	N.	Bottle No. 2579. 5 c.c.	21. 6.98
2	31	Jagnath Mahanand	„	—	99·4	100·2	102·0	98·8	N.	„	—	102·8	99·2	100·0	99·0	N.	„ „	8.10.98
3	73	Vicharam Pudamsey	„	—	98·4	99·8	98·4	98·2	N.	„	—			Not done.			„ „ (No. 3)	14. 5.98
4	32	Jansing Shiva	„	—	98·4	99·6	102·2	99·2	99·2	„	—	100·8	99·0	99·0	98·2	N.	„ „ [Syringe	—
5	36	Mowlabux Bahadur	„	—	100·2	100·0	100·2	99·4	98·4	„	—	102·0	100·6	99·4	98·4	N.	„ „ [leaked.	—
6	4	Mahomed Nansey	„	—	99·6	100·2	101·8	98·4	N.	„	—	102·1	100·8	99·0	98·0	N.	„ „	—
7	26	Rama Dewji	„	—	98·4	100·0	99·0	97·0	N.	„	—			Not done.			„ „	—
8	59	Mahomed Ismail	„	—	100·0	99·0	99·0	98·4	N.	„	—	101·8	101·2	100·0	100·0	N.	„ „	24. 9.98
9	5	Rama Luximon	„	—	99·0	100·0	100·8	98·0	N.	„	—	101·8	99·6	100·0	98·2	N.	„ „	—
10	94	Dharma Tannoo	„	—	100·4	99·8	100·0	99·0	99·4	„	—	99·8	102·0	100·0	98·0	N.	„ „	30. 9.98
11	12	Abdoola Alladin	„	—	101·0	99·0	100·4	97·8	N.	„	—	102·2	99·6	99·8	98·0	N.	„ „	12. 9.98
12	214	Bala Narayan	„	—	98·0	98·4	N.	N.	N.	„	—	100·6	99·6	98·6	98·0	N.	„ „	18.10.98
13	210	Luximon Balu	„	—	100·0	98·4	102·0	98·4	N.	„	—	101·6	101·2	100·0	98·0	N.	„ „	15.10.98
14	136	Tookaram Kundoo	„	—	98·4	100·4	101.2	98·2	99·6	„	—	101·0	99·4	99·0	98·0	N.	„ „	—
15	89	Karim Rahimin	„	—	100·6	101·2	100·4	98·6	N.	„	—	102·0	101·6	100·0	98·2	N.	„ „	6. 1.98
16	35	Hakim Abdoola	„	—	99·2	100·0	101·0	99·0	N.	„	—	101·2	98·8	99·4	98·4	N.	„ „ (No. 16)	10. 5.98
17	24	Jageswar Sayee	„	—	97·0	100·0	101·0	97·6	N.	„	—			Not done.			„ „ [Syringe	—
18	97	Maheshwar Kannoo	„	—	98·0	99·2	100·8	98·4	N.	„	—	102·2	100·2	99·6	100·0	99.0	„ „ [leaked.	—
19	107	Jakha Lakha	„	—	99·8	99·6	99·0	98·4	N.	„	—	100·0	100·2	99·4	98·0	N.	„ „	
20	52	Goolamalli Aboodalli	„	—	99·2	100·2	102·0	99·6	101·4	„	—	103·2	100·8	101·0	99·0	N.	„ „	21. 7·98
21	182	Adamji Tayabji	„	—	99·0	100·4	99·0	99·0	N.	„	—	101·4	100·0	99·0	99·0	N.	„ „	—
22	209	Jaffer Ismail	„	—	100·4	99·0	99·0	98·2	N.	„	—	103·2	101·0	101·2	N.	N.	„ „	30. 9.98
23	143	Hosein Karim	„	—	101·4	99·4	99·4	98·4	N.	„	—	101·2	100·2	100·4	N.	N.	„ „	28.10.98
24	216	Habeebkhan Garibulla	„	—	100·2	98·0	99·8	97·0	N.	„	—	99·4	98·0	N.	N.	N.	„ „	15.11.98
25	160	Pandu Ganu	„	—	101·4	100·4	101·0	98·0	N.	„	—	99·2	101·8	100·4	98·6	N.	Bottle No. 2068. 5 c.c.	10. 5.98
26	6	Sheik Hussein Ahmed	„	—	101·2	99 0	101·0	99·4	100·0	„	—	101·2	101·4	101·4	99·0	99·6	„ „	27. 4.98
27	96	Jankidas Chunilal	„	—	99·6	99·6	N.	98·0	N.	„	—	100·4	99·0	99·0	N.	N.	„ „	16. 6.98
28	135	Khanusar Salene	„	—	99·2	98·6	100·0	98·0	N.	„	—	101·4	99·6	100·0	N.	N.	„ „	6. 8.98
29	194	Suleman Walji	„	—	99·0	99 0	98·0	98·0	N.	„	—	99·8	100·6	100·2	98·8	N.	„ „	—
30	157	Shaik Amir Shaik Chand	„	—	101·0	99·8	98·8	98 0	N.	„	—	101·0	101·4	99·4	N.	N.	„ „	3. 9.98
31	255	Bacha Hassan	„	—	98·0	99·4	98·8	98·0	N.	„	—	100·6	100·0	100·8	99·2	N.	„ „	—
32	21	Kassim Mahomed	„	—	99·6	101·2	99·2	99·2	99·4	„	—	99·4	100·0	100·2	98·8	N.	„ „	30. 4.98
33	88	Mutli Rama	„	—	98·4	100·0	98 0	98·0	N.	„	—	102·8	102·4	101·0	98·4	N.	„ „	11. 6.98
34	109	Framjee Nanabhoy	„	—	98·0	99·0	100·4	98·0	N.	„	—	102·0	99·8	100·2	N.	N.	„ „	—
35	206	Mola Baboo Devi Baboo	„	—	100·0	100·4	101·4	98·0	N.	„	—	103·6	102·0	101·4	99·4	99·2	„ „	30. 9.98
36	176	Muhamad I. A. Karim	„	—	98·2	100·0	100·2	99·0	100·4	„	—	103·2	101·0	101·4	N.	N.	„ „	19. 9.98
37	120	Goolam Alli	„	—	99·0	99·2	99·0	99·0	N.	„	—	100·0	100·2	101·4	N.	N.	„ „	—
38	50	Shaik M. Shaik Hussein	„	—	99·4	100·0	101·2	98·2	N.	„	—	102·0	99·2	101·0	98·0	N.	„ „	31. 1.98
39	188	Alli Mahamad Essufobhoy	„	—	100·6	99·2	101·0	99·4	10 ·0	„	—	101·0	101·8	101·0	99·2	N.	„ „	10. 5.98
40	71	Moti Arjan	„	—	98·4	99·2	99·6	97·2	N.	„	—	100·4	100·8	100·6	N.	N.	„ „	12. 2.98
41	234	Toolasing Amirsing	„	—	99·0	98·8	98·0	98·0	N.	„	—	99·2	98·6	100·0	98·0	N.	„ „	13. 5·98
42	249	Shaik Mohamad Buni Sahib	„	—	99·2	98·6	99·0	98·4	N.	„	—	99·8	98·2	99·0	N.	N.	„ „	—
43	158	Kassim Muhamad	„	—	100·0	99·0	99·0	98·0	N.	„	—	99·4	99·2	101·0	N.	N.	„ „	—

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INOCULATIONS with M. HAFFKINE'S PROPHYLACTIC SERUM: showing the reaction in each case inoculated in Her Majesty's House of Correction, Byculla, Bombay—*continued.*

Serial No.	Prison Register No.	Names of Prisoners.	Date of Inoculation, 2nd time.	Temperature, 3rd.		Temperature, 4th.		Temperature, 5th.		Date of Inoculation, 2nd time.	Temperature, 9th.		Temperature, 10th.		Temperature, 11th.		Remarks.	Date of leaving Jail.
			1898.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	1898.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		
99	36	Vanji Khalow	3rd Jan.	—	99·0	100·0	101·0	97·8	N.	9th Jan.	—	101·2	100·4	101·0	99·4	98·8	Bottle No. 2040. 5 c.c.	23. 8.98
100	196	Adam Abdoola	,,	—	98·0	99·6	99·0	98·0	N.	,,	—	100·0	99·4	101·0	98·4	N.	,, ,,	—
101	264	Ramchandra Heero	,,	—	99·6	98·0	99·6	96·0	N.	,,	—	100·2	100·6	101·0	98·2	N.	,, ,,	20. 1·99
102	129	Shiva Bapu	,,	—	99·4	99·8	102·0	99·2	N.	,,	—	100·4	100·6	100·6	100·2	N.	,, ,,	18. 1.99
103	47	Bhowani Shankar Keshaw	,,	—	100·4	100·4	101·0	99·6	N.	,,	—	101·4	102·0	100·2	98·0	N.	,, ,,	—
104	16	Abdool Alli	,,	—	100·2	99·6	101·0	96·0	N.	,,	—	101·0	101·0	99·2	98·0	N.	,, ,,	11. 7.98
105	84	Dhama Rama	,,	—	100·0	99·4	100·0	N.	N.	,,	—	102·4	99·0	101·0	98·0	N.	,, ,,	—
106	142	N. M. Haji Ahmed	,,	—	98·4	99·0	100·0	N.	N.	,,	—	102·0	101·4	101·0	99·4	N.	,, ,,	—
107	150	Dewji Kanji	,,	—	98·4	99·2	99·4	98·8	N.	,,	—	101·2	100·8	100·6	98·6	N.	,, ,,	—
108	117	Pandoo Bhon	,,	—	100·4	99·4	100·6	98·8	N.	,,	—	102·0	99·0	100·0	99·6	N.	,, ,,	11. 7.98
109	10	Doolaji Dhondu	,,	—	98·4	99·8	100·0	100·6	99·0	,,	—	103·0	101·0	101·0	99·6	99·2	,, ,,	—
110	265	Gana Krishna	,,	—	98·4	99·4	100·0	N.	N.	,,	—	101·4	101·0	102·2	98·4	N.	,, ,,	16.11.98
111	228	Hosain Abdool	,,	—	98·6	99·0	100·0	N.	N.	,,	—	100·0	99·0	100·0	99·4	99·0	,, ,,	30. 9.98
112	170	Kandas Narayandas	,,	—	100·4	100·2	100·4	99·0	99·0	,,	—	101·6	99·0	100·6	98·4	N.	,, ,,	10. 5.98
113	180	Bhailal Kishore	,,	—	99·6	99·6	100·0	99·0	N.	,,	—	99·6	101·6	101·0	99·0	N.	,, ,,	30. 9.98
114	95	Joseph A. De Souza	,,	—	98·6	100·0	99·2	98·8	N.	,,	—	103·0	100·2	101·6	N.	N.	,, ,,	5.12.98
115	70	Antone Miguel	,,	—	98·4	102·0	101·6	N.	N.	,,	—	103·2	100·0	100·0	98·2	N.	Bottle No. 2579.	—
116	93	Bhow Luximon	,,	—	101·2	99·4	100·2	98·2	N.	,,	—	102·0	102·0	101·2	98·6	N.	,,	—
117	223	Narayandas Nathasing	,,	—	101·0	102·0	100·0	98·4	N.	,,	—	100·6	99·0	100·2	98·4	N.	,,	30. 9.98
118	134	Goolam H. Mohideen	,,	—	99·4	98·8	100·6	98·4	N.	,,	—	102·4	101·2	100·6	99·0	N.	,,	—
119	112	Ganoo Rama	,,	—	100·0	99·6	100·0	98·4	N.	,,	—	101·0	99·0	100·4	98·4	N.	,,	—
120	179	Luximon Dooka	,,	—	102·6	99·6	98·4	96·8	N.	,,	—	102·0	98·4	98·4	98·0	N.	,,	12.12.98
121	127	Vishram Soma	,,	—	99·0	98·6	100·0	98·2	N.	,,	—	101·4	100·0	101·0	99·0	N.	,,	19. 7.98
122	241	Marian Francis	,,	—	98·0	100·4	100·6	98·6	N.	,,	—	101·0	99·0	101·6	98·0	N.	,,	—
123	240	Adam L. Yacoob	,,	—	99·2	98·8	98·4	98·4	N.	,,	—	100·0	99·0	99·8	98·2	N.	,,	30. 9.98
124	344	Luximon Devidatt	,,	—	100·0	99·8	100·8	99·0	N.	,,	—	104·0	99·0	103·0	99·0	N.	,,	—
125	202	Appa Babaji	,,	—	100·2	98·8	102·6	101·0	N.	,,	—	102·0	101·2	101·0	101·0	98·2	Bottle No. 2104. 5 c.c.	10.10.98
126	153	Kallia Vithoo	,,	—	99·0	100·2	101·0	98·0	N.	,,	—	101·0	102·0	102·6	99·0	N.	,, ,,	—
127	68	Rowji Balkia	,,	—	98·4	100·6	98·8	98·6	N.	,,	—	100·0	99·4	98·6	98·4	N.	,, ,,	—
128	164	Chand Kasim	,,	—	99·0	99·2	99·8	97·2	N.	,,	—	100·6	98·4	98·8	98·4	N.	,, ,,	22. 1.98
129	11	Ali Omer	,,	—	98·6	98·0	98·0	97·0	N.	,,	—	101·0	N.	99·0	98·0	N.	,, ,, (No. 129)	6. 5.98
130	251	John R. Jones	,,	—	99·0	100·0	100·4	N.	N.	,,	—	101·0	99·0	98·0	N.	N.	,, ,, [Syringe	16. 6.98
131	257	Charles Moore	,,	—	N.	101·0	100·4	N.	N.	,,	—	100·0	99·0	98·0	N.	N.	,, ,, [leaked.	5. 2.98
132	243	Kristo Chundradas	,,	—	99·0	100·0	101·6	98·4	N.	,,	—	99·4	101·6	101·0	100·4	99·0	,, ,,	24. 6.98
133	14	Mahomedalli Ragadin	,,	—	98·6	100·6	100·4	97·2	N.	,,	—	100·0	101·0	101·0	98·0	N.	,, ,,	27. 6·98
134	98	Mahudu Jaishankar	,,	—	99·2	99·4	101·0	99·8	N.	,,	—	102·0	100·0	101·4	98·4	N.	,, ,,	21. 6.98
135	198	Ratna Gosoo	,,	—	98·0	99·0	100·6	98·2	N.	,,	—	Not done.					,, ,,	30. 9.98
136	256	Rustonji Pestonji	,,	—	98·0	100·0	99·4	N.	N.	,,	—	100·4	N.	99·2	98·4	N.	,, ,,	10. 5.98
137	258	Dagdu Rama	,,	—	99·2	99·6	100·2	98·4	N.	,,	—	100·0	100·0	100·0	98·4	N.	,, ,,	—
138	166	Bhagwandas Devidas	,,	—	100·2	102·4	101·4	97·8	N.	,,	—	101·2	100·0	100·2	98·2	N.	,, ,,	10. 5.98

* (Serial No. 84; reg. No. 20) This case died in Jail from tubercle of lung, the symptoms of the disease set in rapidly after inoculation.

The following prisoners were not inoculated on the 9th of January, 1898:—Nos. 73, 26, 24, 165, 82, 132, 200, 85, 113, 20, and 198.
The 50 prisoners against whose names no dates are recorded in the last column were still in Jail on 25th February 1899, when this list was prepared.

A. M. KING,
Assistant Surgeon.

GEORGE WATERS, Lieut.-Colonel, I.M.S.
In Medical Charge, Her Majesty's House of Correction, Byculla.

APPENDIX No. LXI.

STATISTICS

OF

PLAGUE CASES TREATED

IN THE

ARTHUR ROAD HOSPITAL, BOMBAY.

TABLE showing the ADMISSIONS, DEATHS, &c., from PLAGUE at the ARTHUR ROAD HOSPITAL, BOMBAY, from September 1896 to February 1899.

	Number.	Died within 24 hours.	Died within 48 hours.	Total Deaths.	Recovered.	Percentage of Mortality.
1896.						
Sept. and Oct.	88	17	10	46	42	52·23
November	7	9	3	18	9	66·67
December	182	60	63	135	47	74·12
Total	297	86	76	199	98	67·00
1897.						
January	277	90	43	191	86	68·95
February	365	130	46	298	67	81·64
March	193	54	34	130	63	67·35
April	60	17	10	34	26	56·66
May	26	7	1	10	16	38·46
June	42	2	1	6	36	14·28
July	13	1	1	7	6	53·84
August	11	3	—	7	4	63·63
September	33	11	4	22	11	66·66
October	31	6	7	16	15	51·61
November	52	11	6	23	26	50·00
December	167	32	44	115	52	68·68
Total	1,270	364	197	862	408	67·87
1898.						
January	496	139	103	362	134	72·98
February	660	185	140	514	146	77·87
March	454	143	86	341	113	75·11
April	117	29	9	58	59	49·57
May	98	19	6	44	54	44·89
June	12	2	1	4	8	33·33
July	28	5	5	22	6	78·57
August	73	27	15	56	17	76·71
September	91	27	17	75	16	82·41
October	63	25	9	53	10	84·12
November	22	6	2	18	4	81·81
December	72	25	8	55	17	76·38
Total	2,186	632	407	1,602	584	73·28
1899.						
January	166	67	36	137	29	82·53
Grand Total	3,919	1,149	706	2,800	1,119	71·44

B.

TABLE comparing by Months the MORTALITY from PLAGUE at the ARTHUR ROAD HOSPITAL, BOMBAY, from September 1896 to February 1899.

	1896.		1897.		1898.		1899.	
	Admissions.	Mortality.	Admissions.	Mortality.	Admissions.	Mortality.	Admissions.	Mortality.
January	—	—	277	68·95	496	72·98	166	82·53
February	—	—	365	81·64	660	77·87	—	—
March	—	—	193	67·35	454	75·11	—	—
April*	—	—	60	56·66	117	49·57	—	—
May*	—	—	26	38·46	98	44·89	—	—
June*	—	—	42	14·28	12	33·33	—	—
July	—	—	13	53·84	28	78·57	—	—
August	—	—	11	63·63	73	76·71	—	—
September	—	—	33	66·66	91	82·41	—	—
October	88	52·23	31	51·61	63	84·12	—	—
November	27	66·67	52	50·00	22	81·81	—	—
December	182	74·12	167	68·68	72	76·38	—	—
Total	297	67·00	1,270	67·87	2,186	73·28	—	—

* These months show the lowest mortality rates, because convalescent patients from other hospitals were transferred to Arthur Road. these be excluded, the mortality would be as follows :—

1897, May - - 40·00 per cent.
" June - - 22·22 "
1898, April - - 58·41 "
" May - - 54·83 "
" June - - 57·14 "

O.

STATEMENT showing the POSITIONS of BUBOES, MORTALITY, &c. in 2,723 PLAGUE CASES TREATED in the ARTHUR ROAD HOSPITAL, BOMBAY.

	Number.	Died.	Recovered.	Percentage of Mortality.	Right.		Left.	
					Number.	Percentage of Mortality.	Number.	Percentage of Mortality.
Cervical	96	69	27	71·87	67	68·65	29	79·31
Parotid	32	20	12	62·50	12	58·33	20	65·00
Sub-Maxillary	28	21	7	75·00	19	68·42	9	88·88
Axillary	402	298	104	74·12	240	72·50	162	76·54
Pectoral	9	6	3	66·66	5	60·00	4	75·00
Supra-Trochlear	7	4	3	57·14	4	50·00	3	66·66
Femoral	675	429	246	63·55	365	64·38	310	62·58
Inguinal	360	246	114	68·33	180	69·44	180	67·22
Iliac	11	9	2	81·81	4	75·00	7	85·71
Femoral + Inguinal	328	250	78	76·21	137	74·45	191	77·48
Femoral + Inguinal + Iliac	121	91	30	75·20	77	72·85	44	79·54
Femoral + Iliac	62	47	15	75·80	33	75·75	29	75·86
Inguinal + Iliac	73	57	16	78·08	40	77·50	33	78·78
Popliteal	8	4	4	50·00	4	50·00	4	50·00
Occipital	2	1	1	50·00	—	—	—	—
Double Cervical	20	19	1	95·00	—	—	—	—
Double Parotid	11	7	4	63·63	—	—	—	—
Double Axillary	5	4	1	80·00	—	—	—	—
Double Femoral	9	7	2	77·77	—	—	—	—
Double Inguinal	7	7	—	100·00	—	—	—	—
Double Iliac	2	1	1	50·50	—	—	—	—
Double Femoral + Double Iliac	4	1	3	25·00	—	—	—	—
Cervical + Parotid	28	22	6	78·57	10	80·00	18	77·77
Cervical + Parotid + Sub-Maxillary	6	4	2	66·66	—	—	—	—
Double Cervical + Parotid	5	5	—	100·00	—	—	—	—
Cervical + Sub-Maxillary	12	10	2	83·33	—	—	—	—
Cervical + Sub-Inguinal	4	4	—	100·00	—	—	—	—
Cervical + Parotid + Femoral	15	12	3	80·00	—	—	—	—
Double Parotid + Supra-Trochlear	2	1	1	50·00	—	—	—	—
Axillary + Supra-Trochlear + Brachial	16	10	6	62·50	8	50·00	8	75·00
Axillary + Femoral	11	6	5	54·54	—	—	—	—
Axillary + Femoral + Inguinal	24	13	11	54·16	—	—	—	—
Axillary + Parotid	8	7	1	87·50	—	—	—	—
Axillary + Parotid + Double Supra-Trochlear	4	3	1	75·00	—	—	—	—
Axillary + Inguinal	4	2	2	50·00	—	—	—	—
Double Femoral + Inguinal	12	7	5	58·33	—	—	—	—
Femoral + Parotid	7	5	2	71·42	—	—	—	—
Femoral + Iliac + Parotid	6	4	2	66·66	—	—	—	—
Femoral + Iliac + Cervical	13	8	5	61·53	—	—	—	—
Femoral + Inguinal + Cervical	4	2	2	50·00	—	—	—	—
Left Inguinal + Right Femoral	6	5	1	83·33	—	—	—	—
Femoral + Inguinal + Axillary + Supra-Trochlear	2	1	1	50·00	—	—	—	—
Femoral + Inguinal + Cervical + Axillary + Brachial	3	2	1	66·00	—	—	—	—
Inguinal + Cervical	1	—	1	00·00	—	—	—	—
Pneumonic Plague	110	105	5	95·45	—	—	—	—
Without Apparent Buboes	150	102	48	68·00	—	—	—	—
Total	2,723	1,937	786	71·18	—	—	—	—

D.

TABLE showing the SEXES and MORTALITY RATE of each SEX in the 4,000 PLAGUE PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September, 1896 to 10th February, 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	2,924	2,106	818	72·02
Females - -	806	582	224	72·20
Children -	270	173	97	64·07
Total -	4,000	2,861	1,139	71·52

E.

TABLE showing the RACES of 4,000 PLAGUE PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September, 1896 to 10th February, 1899.

Races.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Hindus -	3,372	2,468	904	73·19
Musalmans -	272	178	94	65·44
Native Christians.	315	194	121	61·58
Parsees - -	20	7	13	35·00
Beni-Israel -	21	14	7	66·66
Total -	4,000	2,861	1,139	71·52

F.

TABLE showing by SEXES the PERCENTAGE of each SEX and MORTALITY in 3,372 HINDU PATIENTS, treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September, 1896 to 10th February, 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	2,446	1,814	632	74·16
Females - -	695	505	190	72·37
Children -	231	149	82	64·50
Total -	3,372	2,468	904	73·19

G.

TABLE showing by SEXES, the PERCENTAGE of each SEX and MORTALITY in 272 MUSALMAN PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September, 1896 to 10th February, 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	229	145	84	63·31
Females - -	34	27	7	79·70
Children -	9	6	3	66·66
Total -	272	178	94	65·44

H.

TABLE showing the PERCENTAGE of each SEX and MORTALITY in 315 NATIVE CHRISTIAN PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 26th September 1896 to 10th February 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	224	135	89	60·26
Females -	69	45	24	65·21
Children -	22	14	8	63·63
Total -	315	194	121	61·58

I.

TABLE showing the PERCENTAGE of each SEX and MORTALITY in 20 PARSEE PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September 1896 to 10th February 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	15	5	10	33·33
Females -	4	2	2	50·00
Children -	1	—	1	00·00
Total -	20	7	13	35·00

J.

TABLE showing the PERCENTAGE of each SEX and MORTALITY in 21 BENI-ISRAEL PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September 1896 to 10th February 1899.

Sex.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Males - -	10	7	3	70·00
Females -	4	3	1	75·00
Children -	7	4	3	57·14
Total -	21	14	7	66·66

K.

TABLE showing the MORTALITY RATE according to AGE PERIODS in 4,000 PLAGUE PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from 24th September 1896 to 10th February 1899.

Age Periods.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Under 1 year -	5	—	5	00·00
From 1 to 5 years	52	33	19	63·46
„ 5 „ 10 „	188	125	63	66·48
„ 10 „ 20 „	714	476	238	66·66
„ 20 „ 30 „	1,333	941	392	70·59
„ 30 „ 40 „	1,028	712	316	69·26
„ 40 „ 50 „	414	344	70	83·09
„ 50 „ 60 „	168	146	22	86·90
„ 60 „ 70 „	82	71	11	86·58
„ 70 „ 80 „	13	11	2	84·61
„ 80 „ 90 „	3	2	1	66·66
Total - -	4,000	2,861	1,139	71·52

L.

TABLE showing the MORTALITY RATE by OCCUPATION in 4,000 PLAGUE PATIENTS treated at the ARTHUR ROAD HOSPITAL, BOMBAY, from the 24th of September, 1886 to the 10th of February, 1899.

No.	Occupation.	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
1	Artist	1	--	1	00·00
2	Ayah (Nurse)	28	21	7	75·00
3	Baker	7	3	4	42·85
4	Barber	25	20	5	80·00
5	Basket-maker	3	2	1	66·66
6	Beedee (country cigarettes seller).	1	—	1	00·00
7	Beggar	220	167	53	75·90
8	Blacksmith	13	10	3	76·92
9	Bookbinder	3	2	1	66·66
10	Butcher	6	5	1	83·33
11	Butler	45	33	12	73·33
12	Carpenter	32	24	8	75·00
13	Cart-driver	33	28	5	84·84
14	Clerk	16	10	6	62·50
15	Coachman	41	31	10	75·60
16	Compositor	9	4	5	44·44
17	Compounder	1	—	1	00·00
18	Cook	111	76	35	68·46
19	Coolie	1,100	795	305	72·27
20	Coppersmith	3	2	1	66·66
21	Cotton cleaner	1	1	—	100·00
22	Cultivator	3	3	—	100·00
23	Dhobi (Washerman).	31	25	6	80·64
24	Dyer	3	3	—	100·00
25	Engineer	1	1	—	100·00
26	Fisherman	14	12	2	85·71
27	Fitter	10	4	6	40·00
28	Goldsmith	18	12	6	66·66
29	Goondlee (Musician, religious).	3	3	—	100·00
30	Gawlee (Milkman)	19	17	2	89·47
31	Hawker	22	14	8	63·63
32	Hospital Assistant	1	—	1	00·00
33	Lascar (Arsenal)	1	—	1	00·00
34	Lascar (Fire Brigade)	1	—	1	00·00
35	Malee (Gardener)	19	15	4	78·94
36	Mason	5	2	3	40·00
37	Medical Practitioner	1	1	—	100·00
38	Mill-hand	288	211	77	77·08
39	Painter	9	5	4	55·55
40	Peon	57	42	15	73·68
41	Pleader	1	1	—	100·00
42	Policeman	30	21	9	70·00
43	Polisher	1	1	—	100·00
44	Potter	1	—	1	100·00
45	Printer	11	8	3	72·72
46	Prisoner	17	9	8	52·94
47	Private (Native Infantry).	3	2	1	66·66
48	Railway servant	7	4	3	57·14
49	Sailor	12	5	7	41·66
50	Servant (domestic)	380	274	106	72·10
51	Shoemaker	40	32	8	80·00
52	Shopkeeper	40	26	14	65·00
53	Silk-cleaner	1	1	—	100·00
54	Student	21	10	11	47·61
55	Sweeper	18	10	8	55·55
56	Syce (Groom)	51	43	8	84·31
57	Tailor	48	36	12	75·00
58	Teacher	3	3	—	100·00
59	Teli (Oilman)	5	4	1	80·00
60	Tin-maker	1	1	—	100·00
61	Warder	1	1	—	100·00
62	Ward boy (Hospital).	6	2	4	33·33
63	Weaver	10	5	5	50·00
64	Wool-cleaner	3	—	3	00·00
65	No occupation	1,081	756	325	69·93

APPENDIX No. LXII.

REPORT
BY
KHAN BAHADUR N. H. CHOKSY
ON
CASES OF PLAGUE TREATED WITH PROFESSOR LUSTIG'S SERUM
AT THE
ARTHUR ROAD HOSPITAL, BOMBAY.

Arthur Road Hospital, Bombay,
3rd May 1899.

To the Municipal Commissioners, through the Special Medical Officer and the Executive Health Officer.

SIR,

I HAVE the honour to submit herewith the following report and return of cases treated with Professor Lustig's serum during April 1899:—

1. The number of cases treated was 39, of whom 21 died and 18 recovered, giving a mortality rate of 53·84 per cent. The mortality rate of cases not similarly treated was 77·51 per cent., thus showing a difference of 23·67 per cent. in favour of the former.

2. The cases were divided into the following series:—

Series.	Horse No.	Bleeding.	No. Treated.	No. Died.	No. Recovered.
VIII. (completed).	5	Second	16	10	6
IX.	Donkey	First	2	1	1
X.	3	Second	14	7	7
XI. (to be continued).	1	,,	7	3	4
Total - - - -			39	21	18

3. From a comparison of the returns for February, March, and April, it appears that each succeeding month the serum shows better results as it becomes stronger and more active. And considering that the present epidemic did not show any marked decline till about the middle of April, and that the individual cases do not even yet show any marked diminution in their virulence, in spite of the fact that the epidemic is steadily declining, the results so far achieved should be considered satisfactory. This is better illustrated by the following table, which compares the results during the period:—

Months, 1899.	Mortality Rate of Cases not treated with the Serum.	Mortality Rate of Cases treated with the Serum.	Difference in favour of Serum Cases.
February - -	79·16	70·58	8·58
March - -	79·48	66·21	13·27
April - -	77·51	53·84	23·67

4. The above table shows that whereas the mortality rate has varied very little amongst the cases not treated with the serum, and is not higher than the average rate of all the other hospitals, it shows a very appreciable improvement in those treated with it. And the improvement has steadily bettered from 8·58 per cent. to 23·67 per cent., a difference of over 15 per cent.

5. When all the series of cases are compared, two points are clearly brought out, viz.:—(1.) That the serum obtained from the second bleedings is more active than from the first, and (2) that the serum from the different horses shows different degrees of activity:—

Series.	Horse No.	Bleeding.	No. Treated.	No. Died.	No. Recovered.
I.	5	First	18	14	4
II.	2	,,	11	8	3
III.	3	,,	17	10	7
IV.	2	,,	13	11	2
V.	1	,,	17	12	5
VI.	4	,,	47	30	17
VII.	6	,,	13	8	5
VIII.	5	Second	22	14	8
IX.	Donkey	First	2	1	1
X.	3	Second	14	7	7
XI.	1	,,	7	3	4
Total - - -			181	118	63

The above statement indicates that the results from the first and second bleedings were 68·38 per cent. and 55·81 per cent. respectively, thus clearly indicating a difference in greater activity of 12·57 per cent. from the latter. And as the serum gets stronger at each subsequent bleeding, it is to be expected that better results would be shown in the near future. The serum supplied from Florence last year also showed similar variations between the first and second bleedings.

The table demonstrates that different horses give serums of different activities, and this also materially corroborates the experience of last year, when it was observed that the different horses under experiment at Florence gave serum of different curative values.

6. Including the observations made last year, the total number of cases treated with Professor Lustig's serum now amounts to 349, and the following deductions have been drawn from the experience thus acquired:—

1. That the only known method of treatment that holds out any hope of reducing the high mortality from plague is that by Professor Lustig's curative serum.
2. That where the serum does not avert death, it considerably ameliorates the symptoms, and prolongs the life of the patient.
3. That the serum has, and cannot but have, a limited value in the treatment of the class of patients admitted into the Arthur Road Hospital; patients drawn from the lowest strata of society, badly housed, badly nourished, or half starved, the homeless, the friendless, and the vagrant, picked up from the streets and bye-lanes of the city, and brought to the hospital in a moribund or semi-moribund condition, and after the vital organs have become thoroughly disintegrated by saturation with the plague poison.
4. That if the mortality rate in such patients could be reduced by even 15 per cent., the results should be considered extremely satisfactory.
5. That the serum treatment has long since passed the experimental stage, and that its use should be freely encouraged, so as to collect data on the largest scale possible.
6. That with a view to test the full efficacy and value of the serum, it should be used extensively in early cases, and also in those that are allowed to be treated in their houses by private practitioners.
7. That the best method of using the serum in hospital practice is to exclude all moribund and all convalescent and semi-convalescent patients, and to treat the rest.
8. That if the method above indicated were not followed, it would lead to much unnecessary waste of serum, which could be better applied in more suitable cases.

9. That the statistical method is not the only method of judging of the efficacy of the serum, as it takes no cognisance of the effects in individual cases, and that clinical observation should not be totally ignored as it is of as much, if not more, value in determining its effects.
10. That if any statistical method has to be relied upon for purposes of comparison, it should be between the cases treated with and without serum after the moribund, the convalescent, and semi-convalescent have been excluded from each class.
11. That this method, even, is not free from objections, inasmuch as it takes no account of the individual differences in castes and races, sex, age, location of buboes, duration of illness at the time of treatment, the general condition of the patients, &c., &c., factors which considerably influence the mortality rate in plague, and which must, to a great extent, be similar, if not actually identical, in the two classes of cases taken for comparison.
12. That it is not generally possible to obtain such exact control cases, even if the admissions into the hospitals be very large, and that all deductions drawn from comparison of control cases that do not fulfil the above requirements are open to doubt and are, proportionately, of less relative value.
13. That in the absence of such exact control cases, the method suggested in paragraph 10 is the only feasible and practicable, and open to least errors, especially if a large number of observations are made, the larger the better.
14. That the treatment of every alternate case, as has been suggested, is liable to even greater objection than the method suggested in paragraph 10, as it would entail the waste of serum in moribund cases, cases that nothing short of a miracle could revive, as also its further waste upon convalescent and semi-convalescent patients who are already on the high road to recovery, and who require no further active treatment by drugs or by serum to complete their cure.

N. H. CHOKSY,
Medical Officer in Charge,
Arthur Road Hospital.

The following papers, viz., a Report by Captain Childe, I.M.S., on the treatment of plague cases in Bombay by Galeotti's serum, with lists of cases treated in the Mahratta Hospital, Bombay, and, from the 29th of January 1899 to the 27th March and in May 1899, in the Arthur Road Hospital, Bombay, have been forwarded to the Indian Plague Commission by the Government of Bombay.

REPORT

ON THE

TREATMENT OF PLAGUE IN BOMBAY BY DR. GALEOTTI'S CURATIVE SERUM,

BY

CAPTAIN L. F. CHILDE, I.M.S.

Observations.—The total number of cases treated by Dr. Galeotti's serum, from February 2nd to March 27th, has been 148; of which 125 were treated at the Arthur Road Hospital, 12 were treated at the Maratha Hospital, and 11 were treated at their own houses.

By sex, these 148 persons consisted of 118 males and 30 females (11 being children); and

By caste, there were 117 Hindus, 18 Native Christians, 2 Párais, and 4 Máhomedans.

With regard to duration of disease, it is found that—

30	were treated on the	1st	day of disease.
49	do.	2nd	do.
43	do.	3rd	do.
20	do.	4th	do.
4	do.	5th	do.
1	was do.	6th	do.
1	do.	7th	do
148			

so that 122 out of 148 patients were receiving the serum treatment on or before the 3rd day of plague.

Mortality.—Of the total 148 cases, 99 died, 43 recovered, and 6 are still under treatment.

Out of the 113 adult males, 78 died, 29 recovered, and 6 are under treatment.

Of the 24 adult females, 14 died, 10 recovered.

Of the 11 children, 7 died, 4 recovered.

Mortality by Caste.—Of the 117 Hindus, 80 died, 31 recovered, and 6 are under treatment.

Of the 18 Native Christians, 12 died, 6 recovered.

Of the 9 Párais, 4 died, 5 recovered.

Of the 4 Máhomedans, 3 died, 1 recovered.

Percentage Mortality.—Of all the cases, the percentage of deaths to recoveries is 66·9, but if the 6 cases under treatment be excluded, the percentage mortality is 69·7.

By Sex.—Of the 113 adult males, the mortality is 69·1 per cent., but excluding the 6 cases under treatment, it amounts to 72·9 per cent.

Of the 24 adult females, the mortality is 58·3 per cent.

Of the 11 children, the mortality is 63·6 per cent.

By caste, the mortality is as follows:—

Hindus	68·4	per cent.
Máhomedans	75	do.
Native Christians	66·7	do.
Párais	44·4	do.

1. *General Remarks.*—Selection of cases for treatment. In this enquiry an endeavour was made to confine the treatment to cases of average severity, that is to those who, on admission, seemed to have a reasonable chance of recovery; so that two classes of patients did not receive the serum, namely, those who were obviously moribund, and those whose symptoms were mild, and who were likely to recover, irrespective of treatment. It must be admitted that it is difficult to make a prognosis in any case of plague, as the most unexpected results occur; still, as far as could be judged from the symptoms on admission to hospital, the above selection of cases was made.

2. *Treatment in Addition to the Serum.*—In all cases at the Arthur Road Hospital a stimulant (rum) was given every two hours; and in cases showing symptoms of heart failure cardiac tonics were also administered, such as digitalis, strychnine, strophanthus, caffeine.

3. *Causes of Death.*—These were sudden heart failure, secondary pneumonia, bronchitis, œdema of the lungs, hæmorrhage, or exhaustion; in fact, death was due to the same causes as in plague patients not treated by the serum.

4. *Effects of the Serum Treatment.*—In many cases the temperature fell 1 or 2 degrees shortly after the injection of the serum, and with this fall there was a corresponding improvement in the patient's general condition; but this improvement was often only temporary, and would be observed after each subsequent injection; still, in those patients who died, the general course of the disease was steadily from bad to worse, and their symptoms were practically identical with those of plague patients treated in other ways.

5. *General Conclusions.*—From the evidence of this enquiry it cannot be said that Dr. Galeotti's serum treatment of plague shows any marked curative results; for of the 142 completed cases the mortality is 69·7 per cent., and the general death-rate of plague patients treated in a hospital is only a little higher. I am informed that this rate is 80 per cent., but have no means of verifying the statement; still, accepting this figure as correct, the most that can be claimed for Dr. Galeotti's treatment is a 10 per cent. reduction in mortality.

6. *Evidence of Early Cases.*—Of the 148 cases, 30 received the serum treatment on the first day of disease; and of these 30, 22 died and 8 recovered, so that in this series the death-rate was 73·3 per cent. Now it is an axiom in serum therapeutics that the earlier the treatment, the more favourable the prognosis; yet in this instance we find that the mortality of the patients treated on the first day is higher than that of all the patients who underwent the treatment; the respective figures being 73·3 and 69·7 per cent. This fact points to the same conclusion, namely, that treatment by Dr. Galeotti's serum has not much influence on the course of plague.

L. F. CHILDE, M.B., Captain, I.M.S.,
Acting First Physician, Sir J. J. Hospital.
Bombay, 4th April 1899.

STATEMENT OF WORK

DONE BY

DR. GALEOTTI

WITH NEW SERUM

AT THE

MAHRATTA PLAGUE HOSPITAL, BOMBAY,

UP TO 28TH FEBRUARY 1899.

STATEMENT of WORK done by Dr. GALEOTTI with new SERUM at the MAHRATTA

(*Prepared by Dr. Dhargalker, Chief Medical*

No.	Register No.	Name.	Sex.	Age.	Occupation.	Residence.	Date of Admission.	Date of Disease.
				Years.			1899.	
1	714	Narbada Luxuman -	Female	18	Mill hand	- - - -	2nd February	1st February
2	697	Maroti Gopal - -	Male	20	Do. -	Dongri, Murári Sali's House.	2nd „	1st „
3	720	Sakoo Malji - -	Female	35	Cooly -	Segregation Camp, Mahratta Hospital.	3rd „	2nd „
4	753	Bhiku Ramji - -	Male	6	Nil -	Wari Bundar Segregation Camp.	3rd „	2nd „
5	731	Uma Mahadu - -	Female	15	Do. -	No. 2, Gilder Street -	3rd „	2nd „
6	767	Dugdoo Honaji - -	Male	30	Cooly -	127, Nowroji Hill, North.	4th „	3rd „
7	776	Sai Tukaram - -	Female	15	Do. -	Appa Telli's Chawl, House No. 9.	4th „	3rd „
8	797	Kalapa Basapa - -	Male	20	Do. -	84, Bhandari Street -	5th „	4th „
9	838	Babaji Narayan -	Do.	30	Mill hand	Thoba Wani's Chawl -	7th „	6th „
10	842	Narayan Bhanu - -	Do.	25	Cooly -	Kharwachi Wadi, Fire Brigade, Girgaum.	7th „	6th „
11	848	Ganu Kalu - -	Do.	30	Do. -	2nd Nagpada, Huzari Muhalla.	7th „	6th „
12*	—	Radha Hari - -	Female	20	—	—	11th March -	9th March -

* This statement corresponds to that referred to in Captain Childe's remarks, except that case

PLAGUE HOSPITAL, BOMBAY, up to 28th February 1899.

Officer, Mahratta Plague Hospital.)

No.	Date of Serum injected.	Amount of Serum injected.										Remarks.
		Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	
		1st Day.		2nd Day.		3rd Day.		4th Day.		5th Day.		
1	3rd February	18	15	15	15	19	19	19	—	—	—	Died 8.50 p.m., 6th February 1899.
2	2nd „	15	15	10	—	—	—	—	—	—	—	Recovered.
3	3rd „	20	—	10	—	10	—	—	—	—	—	Died 6 p.m., 6th February 1899. Vapour bath given.
4	3rd „	5	12	10	—	—	—	—	—	—	—	Died 4.30 p.m., 4th February 1899.
5	3rd „	—	10	10	15	10	—	—	—	—	—	Recovered.
6	4th „	19	19	18	19	—	—	—	—	—	—	Died 7.50 p.m., 5th February 1899.
7	6th „	15	—	—	—	—	—	—	—	—	—	Died 5 a.m., 7th February 1899. Vapour bath given.
8	5th „	15	19	19	—	19	—	—	—	—	—	Recovered.
9	7th „	10	19	—	19	—	19	—	—	—	—	Died 12.30 p.m., 11th February 1899.
10	7th „	—	19	19	—	19	15	—	10	—	—	Died 7 a.m., 11th February 1899.
11	7th „	—	15	—	19	—	—	—	—	—	—	Died 10 a.m., 10th February 1899.
12*	—	15	15	16	—	—	—	—	—	—	—	Died 11.30 a.m., 12th March 1899. Heart failure.

No. 12, Radha Hari, appears only in Captain Childe's statement, and not in that of Dr. Dhargalker.

STATEMENT of PLAGUE CASES treated by Dr. GALEOTTI'S

No.	Name.	Date of Admission.	Age.	Sex.	Caste.	Day of Disease.	Date of Serum injected.
	Series.		Years.				
12/1	Girza Babu - 1st	29th January 1899 -	10	Child -	Hindu -	2 days -	29th January 1899 -
14/2	J. J. De Silva - do.	28th do. -	61	Male -	Christian	4 „ -	30th do. -
15/3	Unknown - do.	31st do. -	42	Do. -	Hindu -	1 day -	31st do. -
16/4	Rama Raghu - do.	1st February 1899 -	20	Do. -	Do. -	4 days -	1st February 1899 -
17/5	Bhambu Raju - do.	1st do. -	20	Do. -	Do. -	4 „ -	1st do. -
18/6	Mahadu Ithu - do.	31st January 1899 -	10	Child -	Do. -	4 „ -	1st do. -
19/7	Shiva Issu - do.	1st February 1889 -	40	Male -	Do. -	2 „ -	1st do. -
20/8	Ganesh Khedu - do.	1st do. -	38	Do. -	Do. -	2 „ -	1st do. -
21/9	Biranji Ganesh - do.	1st do. -	25	Female	Do. -	3 „ -	1st do. -
22/10	Deuba Gainu - do.	2nd do. -	18	Male -	Do. -	3 „ -	2nd do. -
23/11	Esu Kondaji - do.	1st do. -	30	Do. -	Do. -	5 „ -	2nd do. -
24/12	Gainu Gosai - do.	2nd do. -	29	Do. -	Do. -	3 „ -	2nd do. -
25/13	Pandu Gopal - do.	2nd do. -	15	Do. -	Do. -	1 day -	2nd do. -
26/14	Shiva Hari - do.	4th do. -	30	Do. -	Do. -	4 days -	4th do. -
27/15	Abba Bala - do.	4th do. -	32	Do. -	Do. -	7 „ -	4th do. -
28/16	Govind Hiru - do.	6th do. -	25	Do. -	Do. -	3 „ -	6th do. -
29/1	Maruthi Jambu - 2nd	3rd do. -	25	Do. -	Do. -	6 „ -	3rd do. -
30/2	Jani Bhawu - do.	2nd do. -	20	Female	Do. -	3 „ -	3rd do. -
31/17	Ramchandra Narayan 1st	8th do. -	22	Male -	Do. -	4 „ -	8th do. -
32/3	J. A. Fernandes - 2nd	3rd do. -	18	Female	Christian	2 „ -	3rd do. -
33/4	Diva Lemba - do.	3rd do. -	28	Male -	Hindu -	4 „ -	3rd do. -
34/5	Marooti Santu - do.	3rd do. -	35	Do. -	Do. -	4 „ -	3rd do. -
35/6	Sambu Ganu - 2nd	4th do. -	2½	Child -	Hindu -	3 days -	4th do. -
36/7	Jumnabai Dulal - do.	4th do. -	6	Do. -	Do. -	2 „ -	4th do. -
37/8	Tribhowan Govind. do.	3rd do. -	18	Male -	Do. -	2 „ -	3rd do. -
38/9	Soma Nathu - do.	5th do. -	15	Do. -	Do. -	1 day -	5th do. -
39/10	Shivram Bhau - do.	5th do. -	12	Do. -	Do. -	2 days -	5th do. -
40/1	Dagru Janu - 3rd	7th do. -	10	Child -	Do. -	1 day -	7th do. -
41/2	Dhondu Bhairu - do.	7th do. -	30	Male -	Do. -	3 days -	7th do. -
42/3	Jai Tukaram - do.	7th do. -	50	Female	Do. -	4 „ -	7th do. -
43/11	Salvador Noronha - 2nd	5th do. -	40	Male -	Christian	3 „ -	5th do. -

NOTE.—From No. $\frac{18}{1}$ to $\frac{148}{18}$ he denominators represent the number of each case in the series of serum injections to which it Bombay, by Dr. Choksy on the 18th March, 1899, in so far as the same cases are included in both, for Dr. Choksy's tables In the cases shown in Dr. Choksy's tables the position of buboes and notes made by Dr. Choksy have been added to the table in this table.

SERUM at the ARTHUR ROAD HOSPITAL, BOMBAY.

No.	Amount of Serum injected.												Result.	Remarks.
	1st Day.		2nd Day.		3rd Day.		4th Day.		5th Day.		6th Day.			
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.		
	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.		
13 / 1	—	18	—	10	—	—	—	—	—	—	—	—	Died 3.15 p.m., 31st January, 1899.	Temperature 106·4°, death from gradual heart failure; right cervical bubo.
14 / 3	20	—	—	—	—	—	—	—	—	—	—	—	Died 2.15 a.m., 31st January, 1899.	Injected on the 6th day; died 4 hours after injection; left inguinal and right femoral buboes.
15 / 3	—	15	—	15	—	15	—	—	—	—	—	—	Died 12 o'clock, 1st February, 1899.	Moribund; life kept up by stimulant injection; right inguinal bubo.
16 / 4	15	15	10	10	10	10	—	—	10	20	15	20	Recovered - -	Septic type; recovery without suppuration of bubo; right inguinal.
17 / 5	15	—	15	—	—	—	—	—	—	—	—	—	Died 10 p.m., 1st February, 1899.	Left axillary bubo; moribund; died 12 hours after admission.
18 / 6	10	10	5	5	5	10	10	10	5	5	5	5	Recovered - -	Septic type, profuse malaria, bubo left axillary, suppurated, good recovery, intestinal hæmorrhage.
19 / 7	—	15	15	15	15	15	10	15	—	15	15	15	Do. - - -	Bubo left axillary with infiltration; septic type; recovery with suppuration.
20 / 8	—	15	10	15	15	15	—	—	—	—	—	—	Died 7 a.m., 4th February, 1899.	Right axillary bubo; improvement and then relapse.
21 / 9	—	15	—	10	15	15	20	20	—	—	—	—	Died 6.50 p.m., 4th February, 1899.	Meningeal symptoms hæmatimesis; left inguinal bubo.
22 / 10	15	—	15	10	—	—	—	—	—	—	—	—	Died 9 p.m., 3rd February, 1899.	Multiple buboes; right axillary, right cervical infiltration.
23 / 11	—	15	—	—	—	—	—	—	—	—	—	—	Died 7 p.m., 3rd February, 1899.	Injected on the 2nd, died 2 hours after injection; right axillary and cervical buboes.
24 / 12	—	15	—	—	—	—	—	—	—	—	—	—	Died 12.15 p.m., 3rd February, 1899.	Left femoral, inguinal and iliac buboes; moribund; died 6 hours after injection.
25 / 13	—	15	18	10	15	15	—	—	—	—	—	—	Died 8 a.m., 5th February, 1899.	Semi-conscious on admission; right femoral inguinal and iliac buboes.
26 / 14	—	15	15	15	15	15	—	—	—	—	—	—	Died 9.15 p.m., 6th February, 1899.	Bubo, left inguinal; death from failure of heart.
27 / 15	—	20	15	20	20	20	15	15	—	—	—	—	Died 6.30 p.m, 12th February, 1899.	Buboes, left inguinal, femoral and iliac, right; lived for 8 days, death from œdema of lungs.
28 / 16	—	20	20	20	20	20	—	—	—	—	—	—	Died 9 p.m., 8th February, 1899.	Heart very feeble, very delirious, life prolonged by stimulant injections; right inguinal and iliac buboes.
29 / 1	10	10	—	—	—	—	—	—	—	—	—	—	Died 10 p.m., 6th February, 1899.	Tetanic injection stopped; right femoral bubo.
30 / 2	15	—	—	—	—	—	—	—	—	—	—	—	Died 12.50 noon, 3rd February, 1899.	Moribund; died 2 hours after injection; right femoral bubo.
31 / 17	—	20	20	20	20	15	15	15	15	—	—	—	Died 21st February, 1899.	Death from œdema of lung; right femoral bubo.
32 / 3	15	15	15	15	10	10	10	10	—	—	—	—	Recovered - -	Right axillary bubo; good recovery without suppuration of bubo.
33 / 4	—	15	15	15	—	—	—	—	—	—	—	—	Died 10.15 a.m., 5th February, 1899.	Unconscious; left femoral and iliac buboes; temperature 105°–106°; heart failure.
34 / 5	—	15	10	10	15	20	20	20	—	—	—	—	Died 10 a.m., 7th February, 1899.	Almost unconscious; left inguinal and axillary buboes; life prolonged by stimulant injections.
35 / 6	5	5	—	—	—	—	—	—	—	—	—	—	Died 6.45 a.m., 5th February, 1899.	Sudden failure of heart; right femoral bubo.
36 / 7	10	—	10	10	—	—	—	—	—	—	—	—	Died 8.30 p.m., 6th February, 1899.	Convulsions and œdema of lungs; right axillary bubo.
37 / 8	—	15	15	15	10	15	10	10	10	10	—	—	Recovered - -	Right femoral bubo; septic type; good recovery; bubo suppurated.
38 / 9	20	20	20	20	15	15	—	20	10	10	10	—	Do. - -	Right inguinal bubo; septic type; good recovery without suppuration.
39 / 10	15	15	15	—	—	—	—	—	—	—	—	—	Died 3.55, 7th February, 1899.	Sudden failure of the heart; left femoral and inguinal bubo.
40 / 1	—	20	20	20	—	—	—	—	—	—	—	—	Died 3 a.m., 8th February, 1899.	Heart failure; left femoral bubo.
41 / 2	—	20	20	15	15	20	20	15	—	—	—	—	Died 9.30 p.m., 17th February, 1899.	Died of exhaustion; right inguinal bubo.
42 / 3	—	20	20	15	—	—	—	—	—	—	—	—	Died 7.30 p.m., 6th February, 1899.	Right femoral and iliac, right axillary buboes.
43 / 11	—	20	20	20	20	20	10	—	10	10	10	—	Died, 23rd February, 1899.	Left femoral inguinal and iliac buboes; died of exhaustion from sloughing of iliac bubo.

belongs. This table, attached to Captain Childe's report, corresponds with tables submitted to the Municipal Commissioner, comprise only Series 1 2 3, 4, cases Nos. 1 to 6, 16 and 17 in Series 5, and Case No. 30 in Series 6 in Captain Childe's tables. published. References have been given to the Charts published in App. No. LXIII. where those Charts relate to cases entered,

STATEMENT of PLAGUE CASES treated by DR. GALEOTTI'S

No.	Name.	Date of Admission.	Age.	Sex.	Caste.	Day of Disease.	Date of Serum injected.
	Series.		Years.				
44	Balu Laku - - 3rd.	8th February 1899 -	18	Male -	Hindu -	1 day -	8th February 1899 -
4							
45	Piri Bapuji - do.	7th do. -	20	Female	Do. -	2 days -	7th do. -
5							
46	Bhawansing Raising. do.	8th do. -	12	Male -	Do. -	2 „ -	9th do. -
6							
47	Dhondu Raghu - do.	8th do. -	19	Do. -	Do. -	4 „ -	9th do. -
7							
48	Kondi Babull - do.	10th do. -	12	Female	Do. -	1 day -	11th do. -
8							
49	Shamji Pitamber - do.	13th do. -	40	Male -	Do. -	3 days -	13th do. -
9							
50	R. M. De Silva - do.	9th do. -	22	Female	Christian	2 „ -	11th do. -
10							
51	Jiji Khandu - do.	14th do. -	12	Do. -	Hindu -	3 „ -	15th do. -
11							
52	Dhondu Sukaram - do.	13th do. -	25	Male -	Do. -	3 „ -	13th do. -
12							
53	Mr. M. (Private) - do.	9th do. -	25	Do. -	Parsi -	2 „ -	10th do. -
13							
54	Chemi Bapu do. - do.	13th do. -	40	Female	Hindu -	1 day -	13th do. -
14							
55	Mrs. S. P. do. - 1st	30th January 1899 -	16	Do. -	Parsi -	2 days -	13th January 1899 -
15							
56	Mrs. K. do. - 3rd	11th February 1899 -	46	Do. -	Do. -	4 „ -	11th February 1899 -
16							
57	Miss K. do. - do.	11th do. -	16	Do. -	Do. -	1 day -	11th do. -
17							
58	Joda Harsayal - 4th	31st do. -	40	Male -	Hindu -	4 days -	21st do. -
1							
59	Jiwa Kalu - - do.	21st do. -	18	Do.	Do. -	2 „ -	21st do. -
2							
60	Parbu Narsu - - do.	21st do. -	30	Do. -	Do. -	3 „ -	21st do. -
3							
61	Hiralal Sah - - do.	21st do. -	35	Do. -	Do. -	3 „ -	21st do. -
4							
62	Nama Rama - do.	24th do. -	35	Do. -	Do. -	2 „ -	24th do. -
5							
63	Ganu Chandria - do.	23rd do. -	22	Do. -	Do. -	2 „ -	24th do. -
6							
64	Gangaram Bhoda - do.	24th do. -	50	Do. -	Do. -	2 „ -	24th do. -
7							
65	Shanker Suka - - do.	24th do. -	5	Child -	Do. -	2 „ -	24th do. -
8							
66	Raghu Krishna - do.	24th do. -	32	Male -	Do. -	3 „ -	24th do. -
9							
67	Sukaram Bapu - do.	25th do. -	18	Do. -	Do. -	2 „ -	25th do. -
10							
68	Dhondu Vithu - do.	26th do. -	12	Do. -	Do. -	3 „ -	26th do. -
11							
69	Ganput Yesu - - do.	25th do. -	22	Do. -	Do. -	2 „ -	26th do. -
12							
70	Babukhan Husain 5th	24th do -	18	Do. -	Musalman	2 „ -	23rd do. -
1							
71	Rama Dagru - do.	26th do. -	25	Do. -	Hindu -	2 „ -	26th do. -
2							
72	Bhau Babaji - do.	26th do. -	19	Do. -	Do. -	2 „ -	26th do. -
3							
73	Reva Begla - - do.	26th do. -	30	Do. -	Do. -	2 „ -	26th do. -
4							
74	Mahadu Tanu - do.	27th do. -	27	Do. -	Do. -	3 „ -	27th do. -
5							
75	Yedu Rama - do.	26th do. -	6	Child -	Do. -	3 „ -	28th do. -
6							
76	Sawaha Dhondi - do.	2nd March, 1899 -	12	Male -	Do. -	5 „ -	2nd March, 1899 -
7							
77	Kondiba Maroti - do.	5th do. -	20	Female	Do. -	2 „ -	5th do. -
8							
78	Walji Tricum do.	5th do. -	10	Child -	Do. -	3 „ -	5th do. -
9							
79	Tricum Purshotam do.	5th do. -	30	Male -	Do. -	3 „ -	5th do. -
10							
80	Harjiwan Tricum - do.	5th do. -	13	Do.	Do. -	3 „ -	5th do. -
11							
81	Abba Bayaji - do.	1st do. -	30	Do.	Do. -	2 „ -	1st do. -
12							

SERUM at the ARTHUR ROAD HOSPITAL, BOMBAY—*continued.*

No.	Amount of Serum injected.												Result.	Remarks.
	1st Day.		2nd Day.		3rd Day.		4th Day.		5th Day.		6th Day.			
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.		
	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c c.	c.c.	c.c.		
44	20	—	—	—	—	—	—	—	—	—	—	—	Died 6.15 p.m., 8th February, 1899.	Moribund; right axillary bubo; died hours after injection; gradual hea failure.
45	—	20	20	15	—	15	15	15	15	15	10	—	Recovered - -	Right axillary bubo, resolved.
46	—	—	15	—	10	10	10	10	—	—	—	—	Do. - -	Left femoral bubo; septic type; good covery without suppuration.
47	—	—	20	—	15	20	15	20	15	10	10	10	Do. - -	Left femoral and iliac bubo; septic type good recovery with suppuration.
48	20	20	20	15	20	20	—	—	—	—	—	—	Died 7.20 a.m., 14th February, 1899.	Right axillary bubo.
49	20	—	—	—	—	—	—	—	—	—	—	—	Died 5 p.m., 13th February, 1899.	Sudden failure of heart; right femoral bub infiltration.
50	20	—	—	—	—	—	—	—	—	—	—	—	Recovered - -	Right posterior, cervical and left femora buboes, resolved.
51	20	20	15	20	7	—	—	—	—	—	—	—	Do. - - -	Left axillary bubo, with infiltration.
52	—	20	20	20	10	—	15	20	20	—	—	—	Died 1 a.m., 18th February, 1899.	From œdema of lungs; right femoral and inguinal bubo.
53	20	20	—	—	—	—	—	—	—	—	—	—	Recovered - -	Left axillary bubo, suppurated.
54	—	20	20	20	10	—	—	—	—	—	—	—	Died 5.30 p.m., 15th February, 1899.	Left femoral bubo.
55	15	15	15	15	15	15	10	5	5	—	—	—	Recovered - -	Bubo right femoral and iliac; had a relapse with iliac bubo on left side.
56	20	20	—	—	—	—	—	—	—	—	—	—	Died 2 a.m., 12th February, 1899.	Mitral regurgitation and diabetes; right femoral and inguinal bubo.
57	20	18	28	—	—	—	—	—	—	—	—	—	Recovered - -	Left femoral and inguinal bubo.
58	—	20	—	—	—	—	—	—	—	—	—	—	Died 9 p.m., 21st February, 1899.	Moribund; died 3 hours after injection; left femoral inguinal and iliac bubo.
59	20	—	—	—	—	—	—	—	—	—	—	—	Died 4 a.m., 22nd February, 1899.	Heart failure; right axillary bubo with infiltration.
60	—	20	20	20	—	—	—	—	—	—	—	—	Died 7.55 p.m., 22nd February, 1899.	Death from secondary pneumonia; left axillary bubo.
61	—	20	20	20	20	—	20	20	—	—	—	—	Died 4 p.m., 3rd March, 1899.	Death from secondary pneumonia; left femoral bubo.
62	20	20	20	20	20	20	—	—	—	—	—	—	Died 6 p.m., 27th February, 1899.	Right inguinal bubo.
63	30	30	20	20	20	20	—	—	—	—	—	—	Died 10 a.m., 27th February, 1899.	Left axillary bubo, with infiltration.
64	20	20	20	20	20	20	—	—	—	—	—	—	Died 7.15, 28th February, 1899.	Right femoral and inguinal bubo.
65	10	10	5	5	5	—	—	—	—	—	—	—	Recovered.	Left femoral bubo; recovered without suppuration.
66	—	20	20	20	20	—	—	—	—	—	—	—	Died 12.30, 26th February, 1899.	Right post cervical bubo.
67	20	20	20	—	—	—	—	—	—	—	—	—	Do.	Left axillary, left post cervical buboes.
68	15	—	—	—	—	—	—	—	—	—	—	—	Died 3.30 p.m, 26th February, 1899.	Moribund; left axillary bubo; died 5 hours after injection.
69	20	—	—	—	—	—	—	—	—	—	—	—	Died 5.30 p.m., 26th February, 1899.	Right, inguinal bubo; died 7 hours after injection.
70	—	15 at his house	20	20	15	20	15	15	—	—	—	—	Died 9.15 a.m., 2nd March, 1899.	Death from secondary pneumonia; septic type; left inguinal bubo.
71	—	20	20	10	—	—	—	—	—	—	—	—	Died 8.30 p.m., 27th February, 1899.	Heart failure; eptic type; left axillary bubo.
72	—	20	20	20	15	10	—	20	15	—	—	—	Died 3.45 a.m., 3rd March, 1899.	Septic type; heart failure; right femoral and iliac bubo.
73	—	20	20	15	10	15	—	—	—	—	—	—	Died 8 p.m., 28th February, 1899.	Died from œdema of lung; left femoral and inguinal bubo.
74	—	30	30	30	20	20	15	—	—	—	—	—	Recovered - -	Right posterior bubo, with infiltration, neck and chest—suppuration.
75	10	10	5	—	—	—	—	—	—	—	—	—	Do. - -	Right femoral bubo.
76	15	15	10	—	—	—	—	—	—	—	—	—	Do. - -	A mixed case of plague and remittent fever.
77	20	—	—	—	—	—	—	—	—	—	—	—	Died 7 p.m., 7th March, 1899.	Heart failure.
78	10	10	5	—	—	—	—	—	—	—	—	—	Died 3.40 a.m., 7th March, 1899.	Do.
79	20	20	10	—	—	—	—	—	—	—	—	—	Died 16th March, 1899.	Marasma and exhaustion.
80	20	15	10	—	—	—	—	—	—	—	—	—	Died 10.45 p.m., 6th March 1899.	Heart failure.
81	—	30	30	30	20	—	20	—	—	—	—	—	Died 8th March 1899.	Secondary pneumonia

STATEMENT of PLAGUE CASES treated by DR. GALEOTTI'S

No.	Name.	Date of Admission.	Age.	Sex.	Caste.	Day of Disease.	Date of Serum injected.
	Series.		Years.				
82	Sonu Babaji - 3rd	21st February, 1899 -	30	Male -	Hindu -	3 days -	21st February, 1899 -
17							
83	Mr. R. P. K. (Private) - - 4th	15th do. -	6	Child -	Parsi -	1 day -	15th do. -
84	Bhagwan Bhana - 5th	6th March, 1899 -	25	Male -	Hindu -	2 days -	6th March, 1899 -
13							
85	Pundharinath Balashet - - do.	6th do. -	22	Do. -	Do. -	2 „ -	6th do. -
14							
86	Vasan Govind - do.	7th do. -	30	Do. -	Do. -	2 „ -	7th do. -
15							
87	Kashibai (Private) do.	27th February, 1899 -	27	Female	Do. -	1 day -	27th February, 1899 -
16							
88	Mr. S. P. C. (Private) - - do.	28th do. -	40	Male -	Portuguese	1 „ -	28th do. -
17							
89	Manecklal Lallu - 6th	4th March, 1899 -	36	Do. -	Hindu -	1 „ -	4th March, 1899 -
1							
90	Rama Sackaram - do.	5th do. -	14	Do. -	Do. -	1 „ -	5th do. -
2							
91	Bhuda Bapu - do.	7th do. -	32	Do. -	Do. -	3 days -	7th do. -
3							
92	Chadulla B. Farid - do.	7th do. -	40	Do. -	Mahomedan.	4 „ -	7th do. -
4							
93	Gaau Gabur - do.	8th do. -	20	Do. -	Hindu -	3 „ -	8th do. -
5							
94	Gaffur Lalla - do.	7th do. -	7	Child -	Mahomedan.	2 „ -	7th do. -
6							
95	Bhiku Ramchandra do.	7th do. -	20	Male -	Hindu -	1 day -	8th do. -
7							
96	Ambu Govinda - do.	6th do. -	18	Do. -	Do. -	2 days -	8th do. -
8							
97	Hurshunkar Buldev do.	8th do. -	45	Do. -	Do. -	3 „ -	8th do. -
9							
98	Nathia Bhau - do.	9th do. -	23	Do. -	Do. -	3 „ -	9th do. -
10							
99	T. V. Mungabun - do.	9th do. -	30	Do. -	Native Christian.	2 „ -	9th do. -
11							
100	Mr. J. B. J. (Private) do.	3rd do. -	11	Do. -	Portuguese	2 „ -	4th do. -
12							
101	Bipati Mebge - - do.	11th do. -	20	Do. -	Hindu -	3 „ -	11th do. -
13							
102	Dagdu Sadu - - do.	11th do. -	30	Do. -	Do. -	3 „ -	12th do. -
14							
103	L. C. Sequera - - do.	12th do. -	45	Do. -	Christian	3 „ -	12th do. -
15							
104	Pandu Janu - - do.	13th do. -	20	Do. -	Hindu -	2 „ -	13th do. -
16							
105	Kessu Lalla - - - do.	12th do. -	60	Do. -	Do. -	2 „ -	13th do. -
17							
106	Bhawanishunker Hary do.	13th do. -	17	Do. -	Do. -	2 „ -	13th do. -
18							
107	Nana Bhana - - do.	13th do. -	25	Do. -	Do. -	2 „ -	13th do. -
19							
108	Francis X. Fernandes do.	13th do. -	20	Do. -	Christian	3 „ -	14th do. -
20							
109	Gunia Sudu - - do.	11th do. -	35	Do. -	Hindu -	4 „ -	14th do. -
21							
110	Apa Bhaukhan - do.	14th do. -	20	Do. -	Do. -	2 „ -	14th do. -
22							
111	Sheva Kondaji - do.	14th do. -	35	Do. -	Do. -	2 „ -	14th do. -
23							
112	Ciprian Fernandes - do.	14th do. -	25	Do. -	Christian	2 „ -	14th do. -
24							
113	John De Costa - do.	15th do. -	30	Do. -	Do. -	3 „ -	15th do. -
25							
114	Sukai Jahari - do.	15th do. -	30	Do. -	Hindu -	4 „ -	15th do. -
26							
115	Deria Isra - - do.	15th do. -	23	Do. -	Do.	5 „ -	15th do. -
27							
116	Mamiaji Yesram - do.	16th do. -	15	Do. -	Do. -	3 „ -	16th do. -
28							
117	Cyprian Alfonso - do.	15th do. -	40	Do. -	Christian	1 day -	16th do. -
29							
118	F. G. (Private) - do.	27th February, 1899 -	14	Do. -	Hindu -	4 days -	——
30							
119	Mrs. H. S. (Private) do.	15th March, 1899 -	56	Female	Parsi -	3 „ -	15th March, 1899 -
31							

SERUM at the ARTHUR ROAD HOSPITAL, BOMBAY—*continued*.

No.	Amount of Serum injected.												Result.	Remarks.
	1st Day.		2nd Day.		3rd Day.		4th Day.		5th Day.		6th Day.			
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.		
	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.		
82	—	40	—	—	—	—	—	—	—	—	—	—	Died 7 a.m., 22nd February, 1899.	Multiple buboes, left femoral, right axillary, right cervical; died 12 hours after injection.
17														
83	49 c.c. total.												Recovered - -	Left femoral and inguinal bubo resolved.
13														
84	20	10	—	—	—	—	—	—	—	—	—	—	Do. - -	——
13														
85	—	15	10	—	—	—	—	—	—	—	—	—	Died 10 p.m., 7th March, 1899.	Heart failure.
14														
86	15	10	10	10	10	—	—	—	—	—	—	—	Died 9.30 p.m., 9th March, 1899.	Secondary pneumonia.
15														
87	110 c.c. total quantity.												Recovered - -	Right femoral bubo.
16														
88	55 c.c. total quantity.												Died 2nd March, 1899.	Heart failure; left femoral inguinal bubo.
17														
89	—	30	15	20	—	—	—	—	—	—	—	—	Died 5th March, 1899.	Do. *See* Chart 9, App. LXIII.
1														
90	—	20	—	—	—	—	—	—	—	—	—	—	Died 6th March, 1899.	Moribund. *See* Chart 10, App. LXIII.
2														
91	18	—	—	—	—	—	—	—	—	—	—	—	Died 7th March, 1899.	Do. *See* Chart 13, App. LXIII.
3														
92	17	—	20	—	15	—	—	—	—	—	—	—	Died 13th March, 1899.	Improvement and then relapse. *See* Chart 14, App. LXIII.
4														
93	15	15	10	—	—	—	—	—	—	—	—	—	Died 8th March, 1899.	Heart failure. *See* Chart 17, App. LXIII.
5														
94	10	10	7	7	—	10	—	—	—	—	—	—	Died 10th March, 1899.	Plague and measles; heart failure. *See* Chart 12, App. LXIII.
6														
95	15	20	—	—	—	—	—	—	—	—	—	—	Died 9th March, 1899.	*See* Chart 15, App. LXIII.
7														
96	—	20	10	10	—	—	—	—	—	—	—	—	Recovered - -	Septic type. *See* Chart 11, App. LXIII.
8														
97	—	20	15	10	10	—	—	—	—	—	—	—	Do. - -	*See* Chart 16, App. LXIII.
9														
98	15	10	—	—	—	—	—	—	—	—	—	—	Died 10th March, 1899.	Heart failure. *See* Chart 18, App. LXIII.
10														
99	—	20	15	15	10	10	—	—	—	—	—	—	Died 13th March, 1899.	Do. *See* chart 19, App. LXIII.
11														
100	—	—	—	—	—	—	—	—	—	—	—	—	Recovered - -	Septic type. *See* chart 7, App. LXIII.
12														
101	—	20	15	15	10	10	10	10	10	—	—	—	Do. - -	*See* chart 20, App. LXIII.
13														
102	—	20	15	10	20	20	—	—	—	—	—	—	Died 15th March, 1899.	Secondary pneumonia. *See* Chart 21, App. LXIII.
14														
103	—	20	10	—	10	15	15	—	—	—	—	—	Do. - -	Fatty heart and do. *See* Chart 22, App. LXIII.
15														
104	20	15	15	15	15	15	—	—	—	—	—	—	Recovered - -	*See* chart 24, App. LXIII.
16														
105	15	15	15	15	10	10	—	—	—	—	—	—	Died 23rd March, 1899.	From exhaustion after 11 days. *See* chart 23, App. LXIII.
17														
106	15	15	10	—	—	—	—	—	—	—	—	—	Recovered - -	*See* chart 25, App. LXIII.
18														
107	—	20	20	20	—	—	—	—	—	—	—	—	Died 15th March, 1899.	Heart failure. *See* chart 26, App. LXIII.
19														
108	20	20	20	15	10	—	—	—	—	—	—	—	Recovered - -	*See* chart 28, App. LXIII.
20														
109	20	15	15	15	10	—	—	—	—	—	—	—	Do. - -	*See* chart 27, App. LXIII.
21														
110	—	20	10	10	16	—	—	—	—	—	—	—	Do. - -	*See* Chart 29, App. LXIII.
22														
111	—	20	20	20	15	20	20	—	15	—	—	—	Do. - -	*See* Chart 30, App. LXIII.
23														
112	—	20	10	—	—	—	—	—	—	—	—	—	Do. - -	*See* Chart 31, App. LXIII.
24														
113	20	20	—	—	—	—	—	—	—	—	—	—	Died 15th March, 1899.	Moribund. *See* Chart 33, App. LXIII.
25														
114	20	20	—	—	—	—	—	—	—	—	—	—	Died 16th March, 1899.	Secondary pneumonia and heart failure. *See* Chart 32, App. LXIII.
26														
115	—	20	10	10	—	—	—	—	—	—	—	—	Recovered - -	*See* Chart 34, App. LXIII.
27														
116	20	20	—	—	—	—	—	—	—	—	—	—	Died 17th March, 1899.	Heart failure. *See* Chart 37, App. LXIII.
28														
117	20	20	10	10	10	10	—	—	—	—	—	—	Died 18th March, 1899.	Do. *See* Chart 35, App. LXIII.
29														
118	70 c.c. total quantity.												Recovered - -	Axillary bubo. *See* Chart 8, App. LXIII.
30														
119	57	c.c.	—	—	—	—	—	—	—	—	—	—	Died 22nd March, 1899.	Heart failure and œdema lung. *See* Chart 36, App. LXIII.
31														

STATEMENT of PLAGUE CASES treated by Dr. GALEOTTI's

No.	Name.	Date of Admission.	Age.	Sex.	Caste.	Day of Disease.	Date of Serum injected.
	Series.		Years.				
120	Bhagwandas Raghu do.	16th March 1899 -	30	Male -	Hindu -	4 days -	16th March 1899 -
32							
121	Doming Caitan - do.	16th do. -	60	Do. -	Christian	1 day -	16th do. -
33							
122	Krishna Vithu - do.	17th do. -	40	Do. -	Hindu -	3 days -	17th do. -
34							
123	Cosme Damian - do.	17th do. -	23	Do. -	Christian	3 „ -	17th do. -
35							
124	Walla Prema - do.	17th do. -	28	Do. -	Hindu -	4 „ -	17th do. -
36							
125	Gandaram Karamchand. do.	16th do. -	30	Do. -	Do. -	4 „ -	17th do. -
37							
126	Mrs. Moses - do.	17th do. -	30	Female	Christian	4 „ -	17th do. -
38							
127	Babaji Zora - do.	17th do. -	40	Male -	Hindu -	3 „ -	18th do. -
39							
128	Peter Fernandes - do.	18th do. -	30	Do. -	Christian	2 „ -	18th do. -
40							
129	Maruti Ganu - do.	18th do. -	20	Female	Hindu -	3 „ -	18th do. -
41							
130	Miss J. B. S. (Private) do.	17th do. -	16	Do. -	Parsi -	2 „ -	17th do. -
42							
131	Sawatie Saurela - do.	18th do.	35	Do. -	Hindu -	2 „ -	18th do. -
43							
132	Francis Periera - do.	18th do. -	30	Male -	Christian	1 day -	18th do. -
44							
133	Antone Salvador Lobo. do.	18th do. -	60	Do. -	Do. -	3 days -	18th do. -
45							
134	Shaik Madar - do.	18th do -	30	Do. -	Hindu -	3 „ -	18th do. -
46							
135	Pedro Bustaw De Costa. 6th	18th do. -	42	Do. -	Christian	1 day -	18th do. -
47							
136	Piran Amer - 7th	16th do. -	35	Do. -	Mahomedan.	2 days -	16th do. -
1							
137	Sawla Mahado - do.	18th do. -	35	Do. -	Hindu -	1 day -	18th do. -
2							
138	Dhondu Krishna - do.	19th do. -	30	Do. -	Do. -	3 days -	19th do. -
3							
139	Sittia Balloo - do.	20th do. -	22	Do. -	Do. -	3 „ -	20th do. -
4							
140	Michal Francis - do.	21st do. -	14	Do. -	Christian	2 „ -	21st do. -
5							
141	Sonia Premia - do.	22nd do. -	12	Do. -	Hindu -	5 „ -	23rd do. -
6							
142	Nama Rowji - do.	23rd do. -	25	Do. -	Do. -	1 day -	23rd do. -
7							
143	Bhagla Puchya - do.	24th do. -	18	Do. -	Do. -	3 days -	24th do. -
8							
144	Mahadeo Panga - do.	25th do. -	25	Do. -	Do. -	2 „ -	25th do. -
9							
145	Bhagwan Hanuiman do.	25th do. -	18	Do. -	Do. -	2 „ -	26th do. -
10							
146	Tatya Babaji - do.	25th do. -	25	Do. -	Do. -	1 day -	26th do. -
11							
147	Ratan Dhana - do.	26th do. -	14	Do. -	Do. -	2 days -	27th do. -
12							
148	Babaji Dhakoo - do.	27th do. -	30	Do. -	Do. -	3 „ -	27th do. -
13							

SERUM at the ARTHUR ROAD HOSPITAL, BOMBAY—*continued.*

No	Amount of Serum injected.												Result.	Remarks
	1st Day.		2nd Day.		3rd Day.		4th Day.		5th Day.		6th Day.			
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.		
	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.	c.c.		
120	—	10	10	10	10	—	10	—	—	—	—	—	Recovered - -	*See* Chart 38, App. LXIII.
32														
121	—	20	15	10	10	—	—	—	—	—	—	—	Died 18th March, 1899.	Œdema lung and heart failure. *See* Chart 39, App. LXIII.
33														
122	20	20	15	15	—	—	—	—	—	—	—	—	Died 19th March, 1899.	Heart failure. *See* Chart 41, App. LXIII.
34														
123	30	20	20	15	20	—	—	—	—	—	—	—	Do. -	Do. *See* Chart 42, App. LXIII.
35														
124	—	20	15	10	10	—	—	—	—	—	—	—	Died 20th March, 1899.	Œdema lung. *See* Chart 46, App. LXIII.
36														
125	—	20	15	10	10	10	—	—	—	—	—	—	Do. - -	Septic type. *See* Chart 40, App. LXIII.
37														
126	—	20	20	10	5	10	5	—	—	—	—	—	Recovered - -	*See* Chart 45, App. LXIII.
38														
127	15	10	10	15	10	—	—	—	—	—	—	—	Died 26th March, 1899.	Secondary pneumonia. *See* Chart 43, App. LXIII.
39														
128	20	10	10	—	—	—	—	—	—	—	—	—	Died 19th March, 1899.	Heart failure. *See* Chart 47, App. LXIII.
40														
129	20	15	15	15	5	—	—	—	—	—	—	—	Recovered - -	*See* Chart 48, App. LXIII.
41														
130	50	c.c.	—	—	—	—	—	—	—	—	—	—	Died 19th March, 1899.	Heart failure. *See* Chart 44, App. LXIII.
42														
131	—	20	15	20	—	—	—	—	—	—	—	—	Died 20th March, 1899.	Bronchitis. *See* Chart 49, App. LXIII.
43														
132	—	20	15	—	—	—	—	—	10	—	—	—	Recovered.	
44														
133	—	15	20	—	—	—	—	—	—	—	—	—	Died 19th March, 1899.	Heart failure. *See* Chart 50, App. LXIII.
45														
134	—	15	15	—	—	—	—	—	—	—	—	—	Do. - -	Do. *See* Chart 51 App. LXIII.
46														
135	—	15	20	15	15	10	—	—	—	—	—	—	Died 22nd March, 1899.	Secondary pneumonia. *See* Chart 53 App. LXIII.
47														
136	—	30	20	20	15	—	10	—	10	—	—	—	Recovered.	
1														
137	—	30	20	—	—	—	—	—	—	—	—	—	Died 20th March, 1899.	Moribund and heart failure.
2														
138	20	10	10	10	5	—	—	—	—	—	—	—	Recovered.	
3														
139	15	15	15	15	—	15	10	15	—	—	—	—	Died 24th March, 1899.	
4														
140	—	20	15	15	15	10	10	—	—	—	—	—	Do. - -	Heart failure.
5														
141	15	15	15	10	10	10	7	5	—	—	—	—	?	
6														
142	—	20	20	—	—	—	—	—	—	—	—	—	Died 24th March, 1899.	Heart failure.
7														
143	20	15	15	15	10	15	—	15	—	—	—	—	?	
8														
144	20	20	15	10	10	10	—	—	—	—	—	—	?	
9														
145	20	20	15	15	15	—	—	—	—	—	—	—	?	
10														
146	20	—	—	—	—	—	—	—	—	—	—	—	Died 27th March, 1899.	Secondary pneumonia.
11														
147	15	15	10	—	—	—	—	—	—	—	—	—	?	
12														
148	—	20	15	—	—	—	—	—	—	—	—	—	?	
13														

The following STATEMENTS of CASES treated with GALEOTTI'S SERUM in the ARTHUR ROAD, HOSPITAL,
Letter dated

SERIES XI.—HORSE No. 1.

General No.	Serial No.	Date of Admission.	Names.	Age.	Sex.	Caste	Duration.
1	8	1st May	Matarba Ittu	35	Male	Hindu	4 days
2	9	2nd ,,	Chandri, wife of Anjia	28	Female	Do	5 ,,
3	10	2nd ,,	Dhondu Anjia	6	Male	Do	5 ,,
4	11	2nd ,,	Laxmi Hari	28	Female	Do	4 ,,
5	12	4th ,,	Khrishna Dhondi	35	Male	Do	3 ,,
6	13	6th ,,	Shivdatdas Sadu	35	Do.	Do.	2 ,,
7	14	7th ,,	Bhiwa Dada	35	Do.	Do.	2 ,,
8	15	8th ,,	Kavel Lama	20	Do.	Do.	8 ,,
9	16	10th ,,	Anusuya Dhondiba	6	Female	Do.	5 ,,
10	17	13th ,,	Valabh Nagar	30	Male	Do.	5 ,,
11	18	15th ,,	Chandrabai Balla	30	Female	Do.	2 ,,
12	19	23rd ,,	Kalidin Bind	30	Male	Do.	4 ,,
13	20	26th ,,	Anandi Bhowani	22	Female	Do.	3 ,,
14	21	27th ,,	Jayi Rama	30	Do.	Do.	2 ,,
15	22	30th ,,	Mulla Kanna	14	Male	Do.	4 ,,

SERIES XII.—HORSE

16	1	21st May	Mr. C. F. D.	43	Male	Parsi	4 days
17	2	24th ,,	Mr. Kharagett	53	Do.	Do.	3 ,,

BOMBAY, were submitted by DR. CHOKSY to the MUNICIPAL COMMISSIONERS, BOMBAY, with his 8th June 1899.

(2nd Bleeding) (Completed).

General No.	Bubo.	Quantity injected.	Died.	Recovered.	Remarks.
1	Left femoral - -	60 c. c. -	—	Recovered.	
2	Right axillary - -	110 c. c. -	6th May 1899 -	—	Death from œdema of lung.
3	Over left lower ribs - -	30 c. c. -	—	Recovered.	
4	Right inguinal - -	50 c. c. -	—	Do.	
5	Right femoral and inguinal -	85 c. c. -	6th May 1899 -	—	Sudden heart failure.
6	Right inguinal - -	70 c. c. -	7th do. -	—	Sudden heart failure from diarrhœa.
7	Left femoral - - -	60 c. c. -	8th do. -	—	Acute œdema of lung, diarrhœa, heart failure.
8	Right axillary with infiltration	55 c. c. -	—	Recovered.	Suppuration of infiltration.
9	Left inguinal - - -	20 c. c. -	—	Do.	
10	Right axillary - - -	35 c. c. -	18th May 1899 -	—	Death from œdema of lung.
11	Right posterior cervical -	60 c. c. -	—	Recovered.	
12	Left femoral - -	40 c. c. -	24th May 1899 -	—	Pneumonic plague, death from heart failure.
13	Right inguinal - -	55 c. c. -	28th do. -	—	Heart failure, very delirious on admission, with failing pulse.
14	Right axillary supra trochlear	80 c. c. -	28th do. -	—	Pregnant, aborted next morning, admitted with œdema of lung.
15	Right femoral - -	35 c. c. -	—	Recovered.	Death from heart failure.

No. 4 (2nd Bleeding).

16	Right inguinal - -	105 c. c. -	—	Recovered.	Plague and malaria.
17	Right axillary with extensive infiltration on chest and shoulder.	135 c. c. -	27th May 1899 -	—	Chyluria fatty heart. Heart failure gradual.

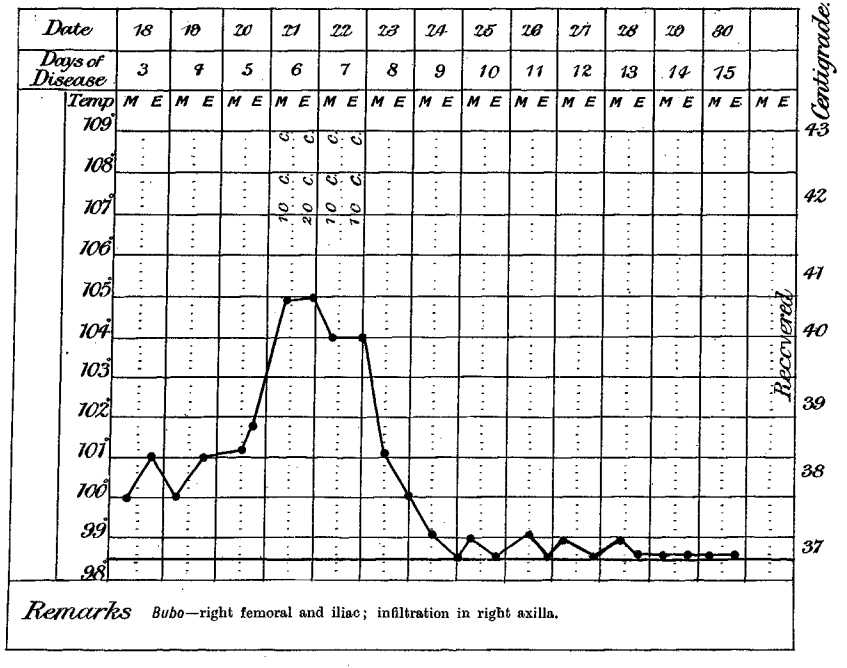
APPENDIX No. LXIII. (*See Question No.* 20,938.)

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

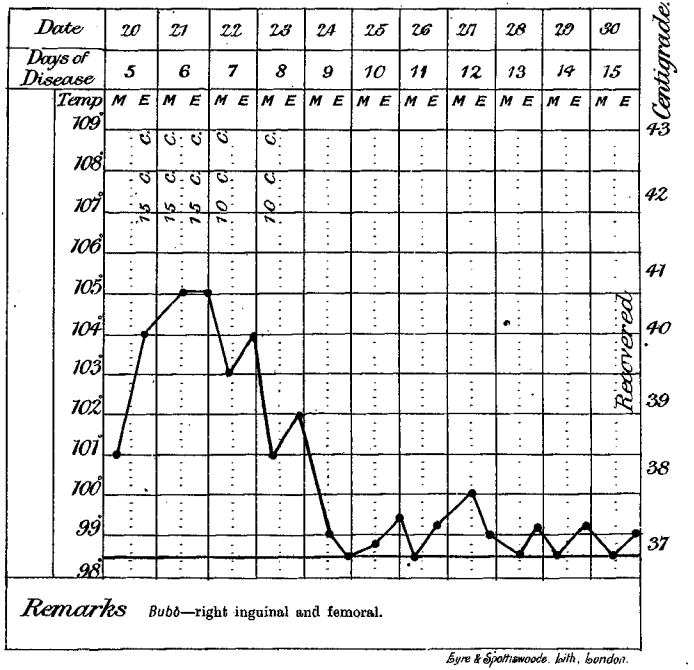
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—18th June 1897.
General Number—
Name—ARDAD ULLA. *DIAGNOSIS*—Plague.
Occupation—Fireman. *Sex*—Male. *Age*—30.
Previous Duration—3 Days. *Caste*—Muhammadan.



Remarks *Bubo*—right femoral and iliac; infiltration in right axilla.

2. *Date of Admission*—20th June 1897.
General Number—
Name—KASINATTI BALLA. *DIAGNOSIS*—Plague.
Occupation—Domestic Servant. *Sex*—Male. *Age*—30.
Previous Duration—5 Days. *Caste*—Hindu.



Remarks *Bubo*—right inguinal and femoral.

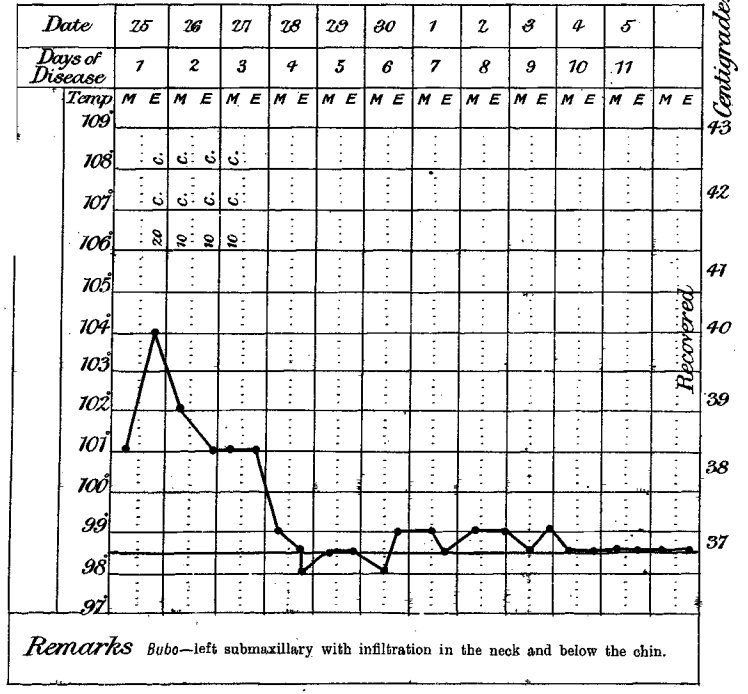
Eyre & Spottiswoode, Lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

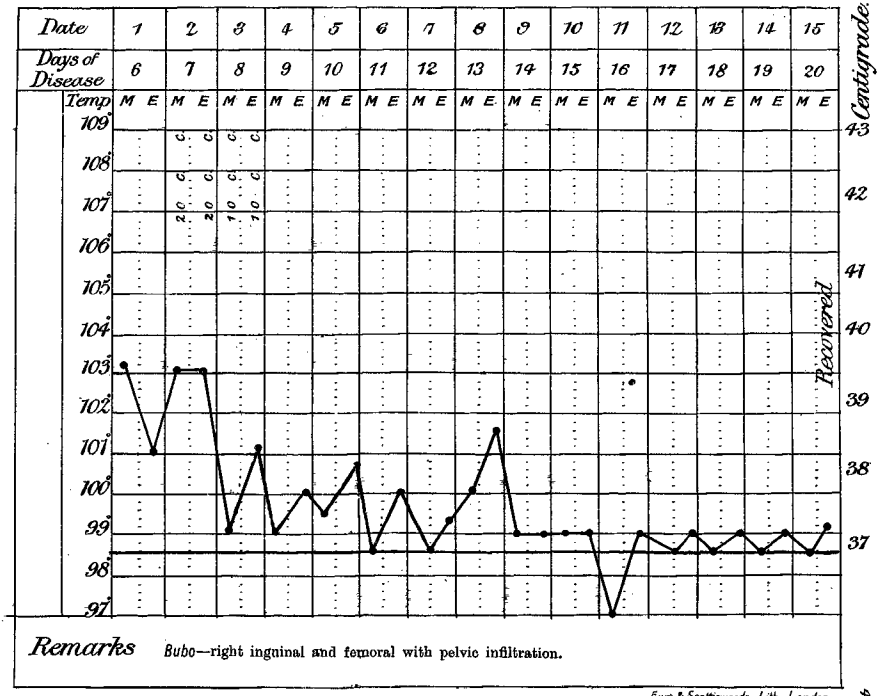
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—25th June 1897.
General Number— *DIAGNOSIS*—Plague.
Name—SAYEE GANPAT. *Sex*—Female. *Age*—8.
Occupation— *Caste*—Hindu.
Previous Duration—1 Day.



Remarks *Bubo*—left submaxillary with infiltration in the neck and below the chin.

4. *Date of Admission*—1st July 1897.
General Number— *DIAGNOSIS*—Plague.
Name—DAVU GOVIND. *Sex*—Female. *Age*—16.
Occupation— *Caste*—Hindu.
Previous Duration—6 Days.



Remarks *Bubo*—right inguinal and femoral with pelvic infiltration.

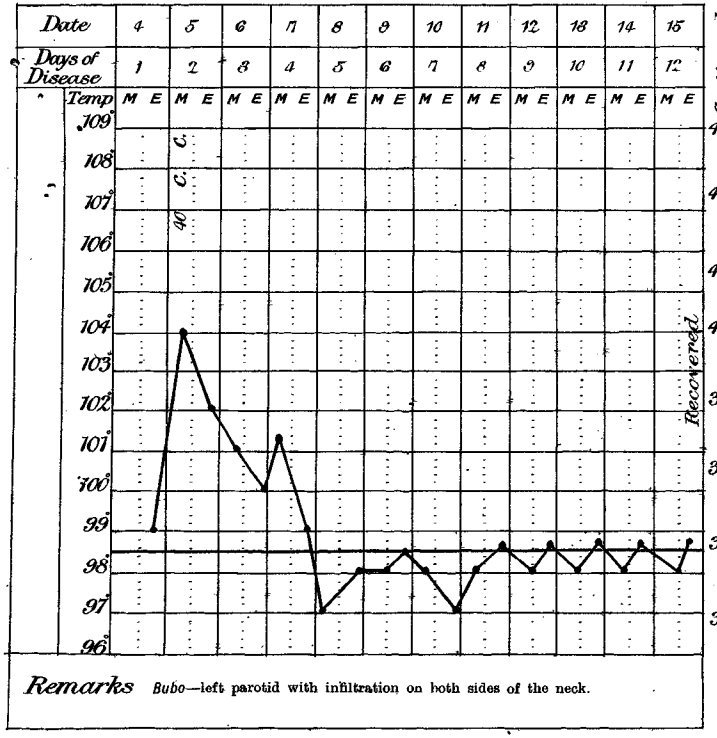
Eyre & Spottiswoode, Lith, London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

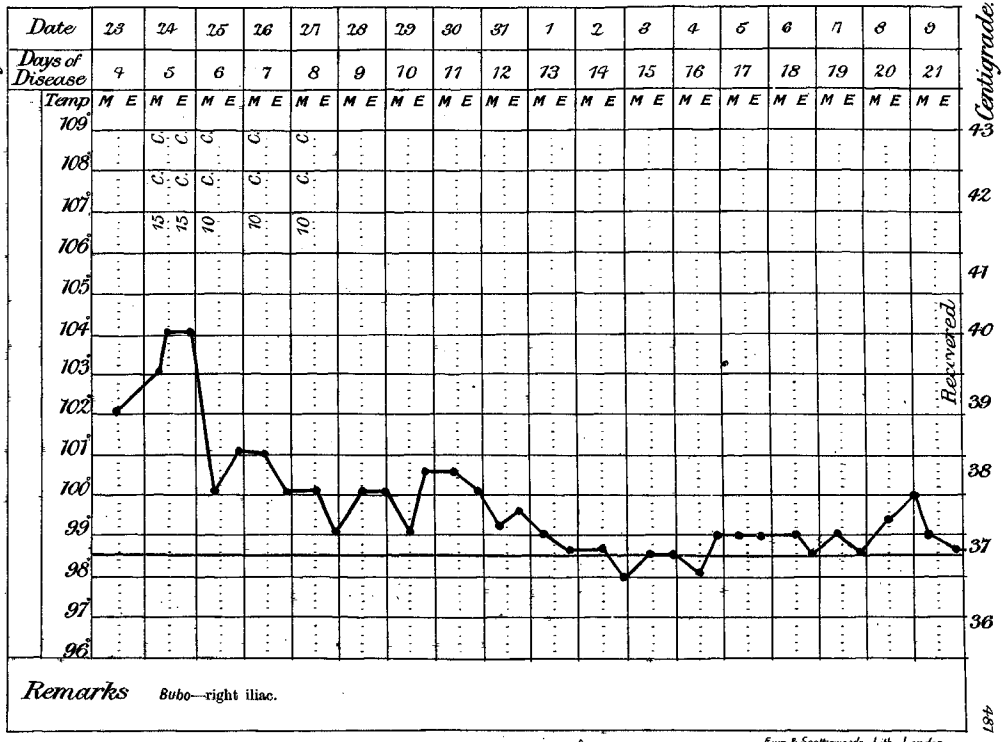
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

5. *Date of Admission*—4th July 1897.
General Number— *DIAGNOSIS*—Plague.
Name—SAKDU TABIA. *Sex*—Male. *Age*—9.
Occupation— *Caste*—Hindu.
Previous Duration—1 Day.



Remarks *Bubo*—left parotid with infiltration on both sides of the neck.

6. *Date of Admission*—23rd July 1897.
General Number— *DIAGNOSIS*—Plague.
Name—GANGOO BALA. *Sex*—Male. *Age*—12.
Occupation— *Caste*—Hindu.
Previous Duration—4 Days.



Remarks *Bubo*—right iliac.

Eyre & Spottiswoode. Lith, London.

APPENDIX No. LXIV. (*See Question No.* 21,033.)

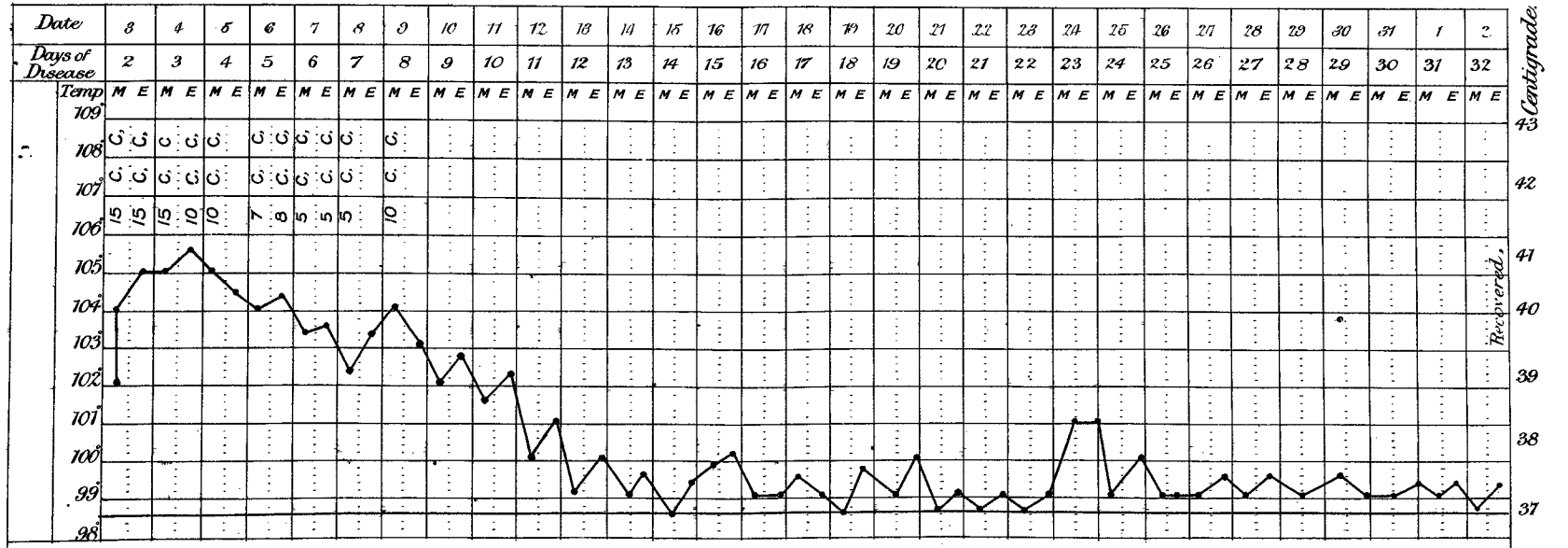
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

7. *Date of Admission*—3rd March 1899. *General Number*— *DIAGNOSIS*—Plague.

Name—J. B. J. *Sex*—Male, *Age*—11. *Occupation*—Student. *Caste*—Parsee. *Previous Duration*—2 Days.



Remarks *Bubo*—left femoral and left iliac; mesenteric glands secondarily infected; good recovery.

Eyre & Spottiswoode. Lith., London.

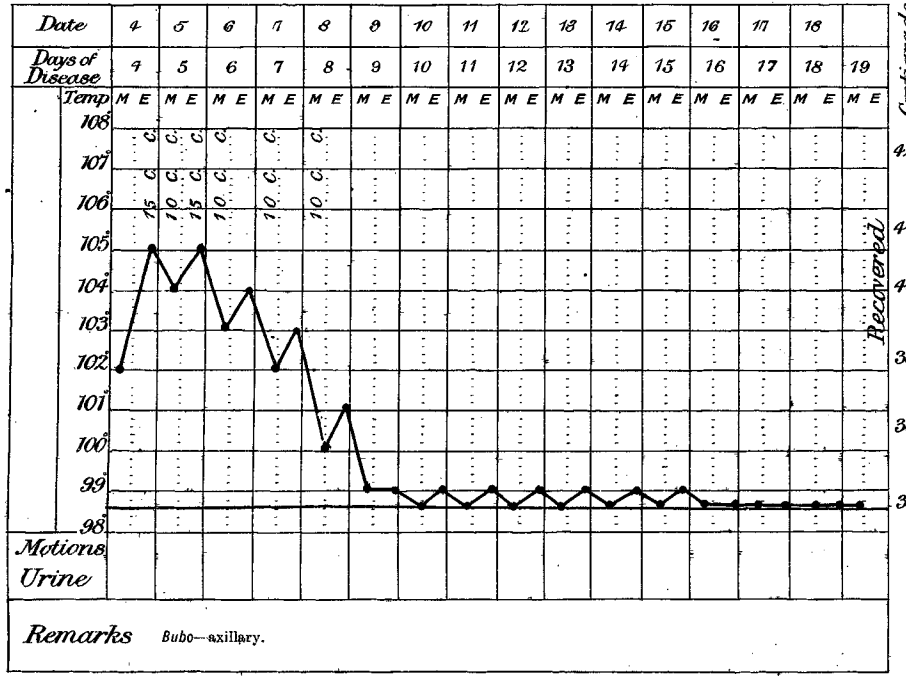
APPENDIX No. LXIV. *(See Question No. 21,033.)*

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

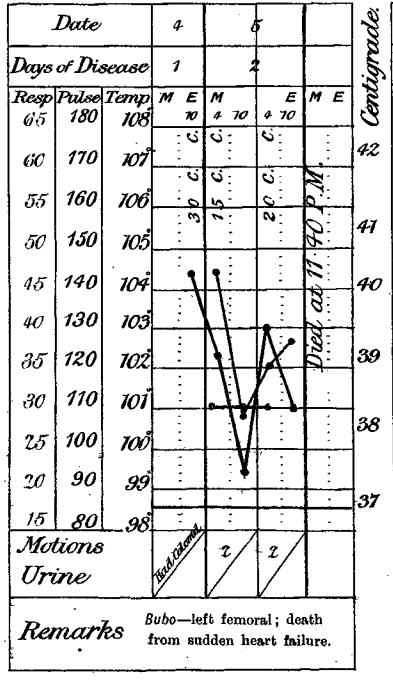
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

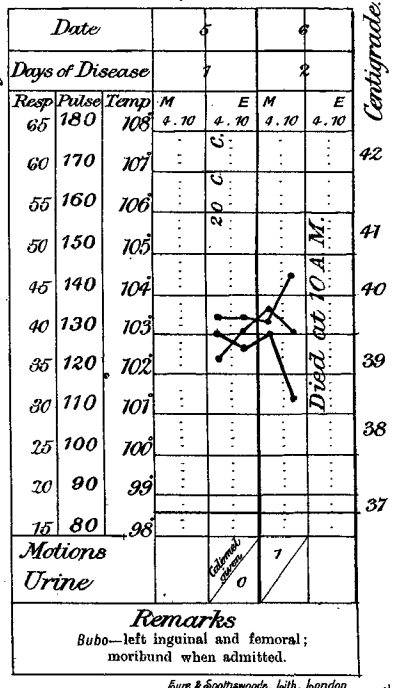
Date of Admission—27th February 1899.
General Number— *DIAGNOSIS*—Plague.
Name—F. G. *Sex*—Male. *Age*—14.
Occupation—Nil. *Caste*—Hindu.
Previous Duration—4 Days.



9. *Date of Admission*—4th March 1899.
General Number—850. *DIAGNOSIS*—Plague.
Name—MANEKLAL LALLOO. *Sex*—Male. *Age*—36.
Occupation—Milkman. *Caste*—Hindu.
Previous Duration—1 Day.



10. *Date of Admission*—5th March 1899, at 1.20 p.m.
General Number—863. *DIAGNOSIS*—Plague.
Name—RAMA SUCCARAM. *Sex*—Male. *Age*—14.
Occupation—Table Boy. *Caste*—Hindu.
Previous Duration—1 Day.



Eyre & Spottiswoode, lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

11. *Date of Admission*—6th March 1899, at 11.15 a.m. *General Number*—883. *DIAGNOSIS*—Plague.

Name—AMBOO GOVINDA. *Sex*—Male. *Age*—18. *Occupation*—Table Boy. *Caste*—Hindu. *Previous Duration*—2 Days.

Date	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5
Days of Disease	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Resp	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E
Motions	2	0	0	1	0	0	0	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
Urine	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1

Pulse: 65 60 55 50 45 40 35 30 25 20 15 — 180 170 160 150 140 130 120 110 100 90 80 70 60

Temp: 108° 107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96°

Centigrade: 42 41 40 39 38 37 36

20-C-C 10-C-C 10-C-C

Discharged cured 3C-4-99.

Remarks *Bubo*—double inguinal and right femoral.

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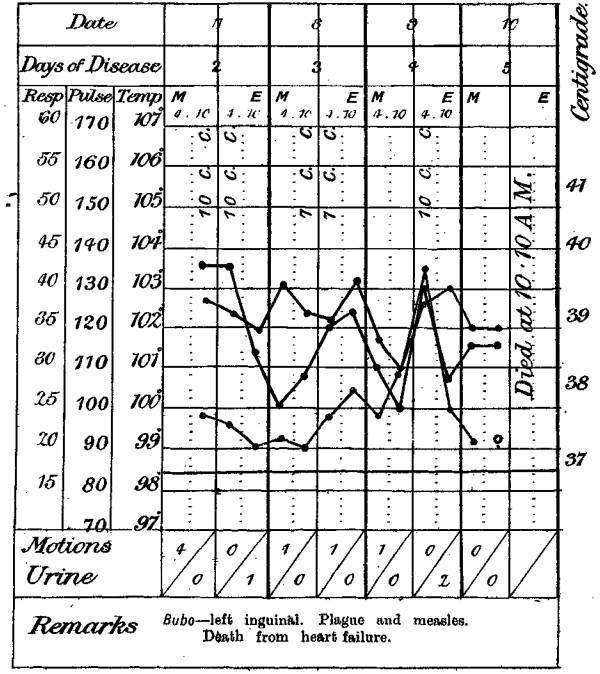
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

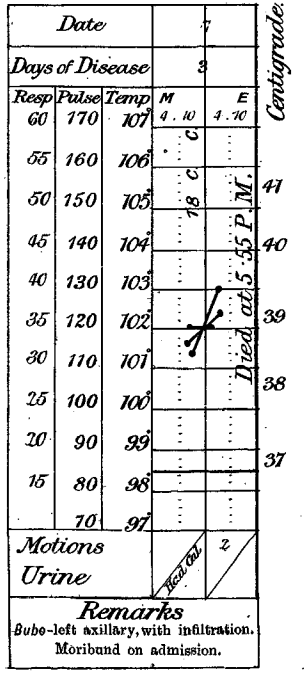
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

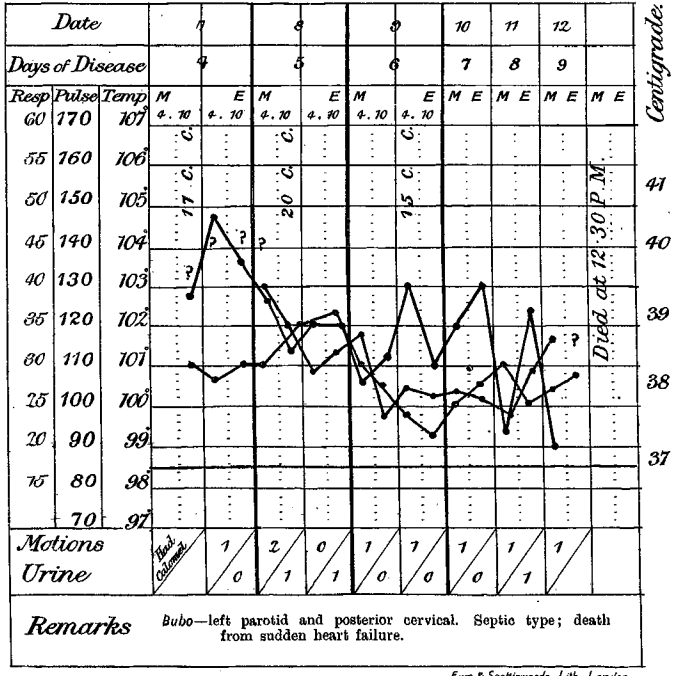
Date of Admission—7th March 1899, at 8.15 a.m.
General Number—897. *DIAGNOSIS*—Plague.
Name—GAFFOOR LALLA. *Sex*—Male. *Age*—7.
Occupation—Nil. *Caste*—Musalman.
Previous Duration—2 Days.



13. *Date of Admission*—7th March 1899, at 9 a.m.
General Number—899. *DIAGNOSIS*—Plague.
Name—BINDA BAPOO. *Age*—32.
Occupation—Mill Hand. *Caste*—Hindu.
Previous Duration—3 Days. *Sex*—Male.



14. *Date of Admission*—7th March 1899, at 9.50 a.m.
General Number—903. *DIAGNOSIS*—Plague.
Name—CHADULLA B. FARID. *Sex*—Male. *Age*—40.
Occupation—Labourer. *Caste*—Musalman.
Previous Duration—4 Days.



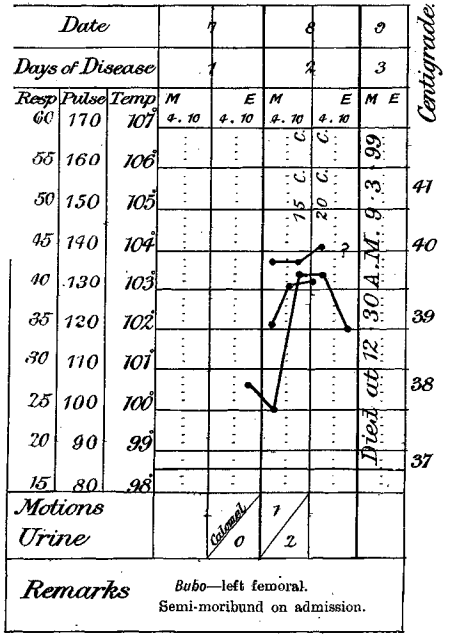
Eyre & Spottiswoode, lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

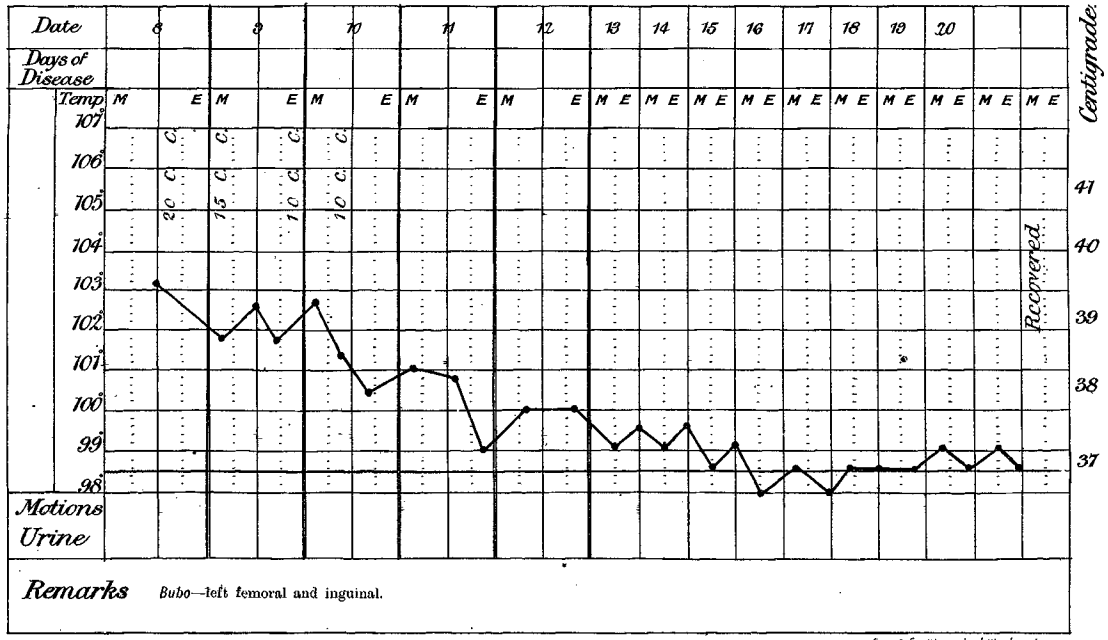
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—7th March 1899, at 8.30 p.m. *DIAGNOSIS*—Plague.
General Number—921.
Name—BHICOO RAMCHANDRA. *Sex*—Male. *Age*—20.
Occupation—Mill Hand. *Caste*—Hindu.
Previous Duration—1 Day.



16. *Date of Admission*—8th March 1899.
General Number—936. *DIAGNOSIS*—Plague.
Name—HARSHANKAR BULDEV. *Sex*—Male. *Age*—45.
Occupation—Ramoosee. *Caste*—Hindu.
Previous Duration—3 Days.



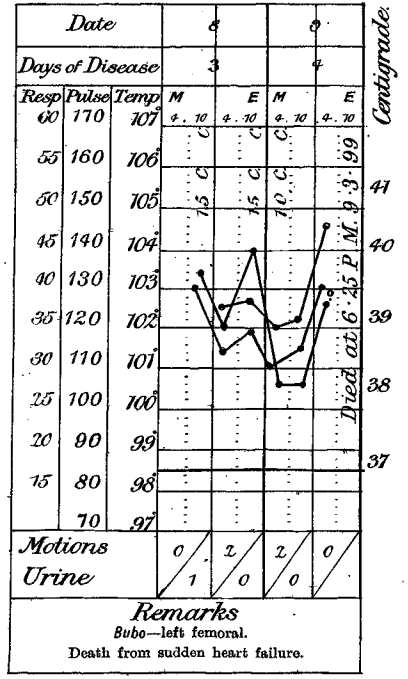
Eyre & Spottiswoode. Lith. London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

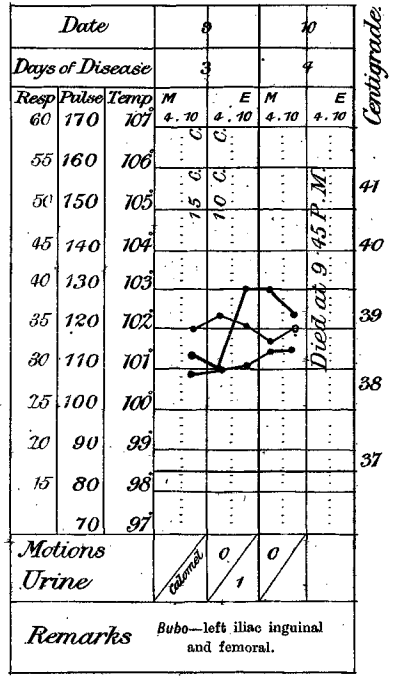
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

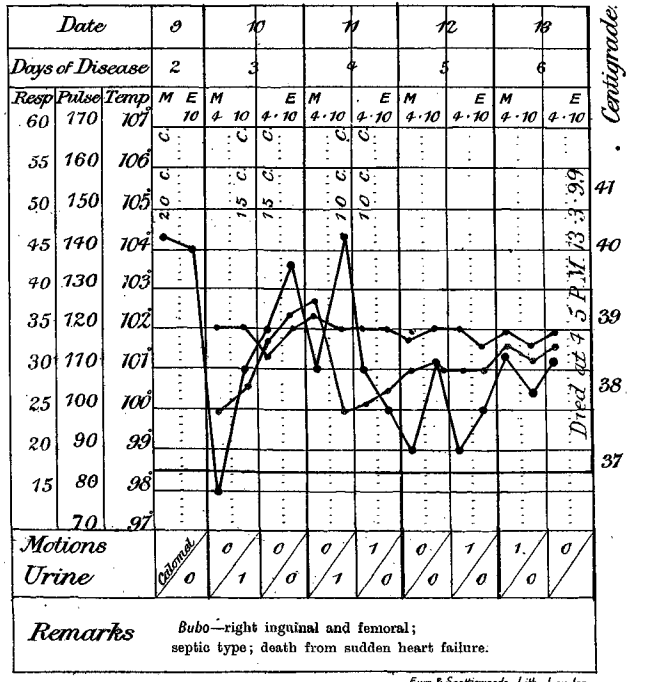
17. *Date of Admission*—8th March 1899, at 9.30 a.m.
General Number—924. *DIAGNOSIS*—Plague.
Name—GANOO GABOOR. *Sex*—Male. *Age*—20.
Occupation—Cook. *Caste*—Hindu.
Previous Duration—3 Days.



18. *Date of Admission*—9th March 1899, at 9.55 a.m.
General Number—955. *DIAGNOSIS*—Plague.
Name—NATHIA BHAOO. *Sex*—Male. *Age*—28.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—3 Days.



19. *Date of Admission*—9th March 1899, at 5.45 p.m.
General Number—969. *DIAGNOSIS*—Plague.
Name—T. V. MUNGABEEN. *Sex*—Male. *Age*—30.
Occupation—Clerk. *Caste*—Christian.
Previous Duration—2 Days.



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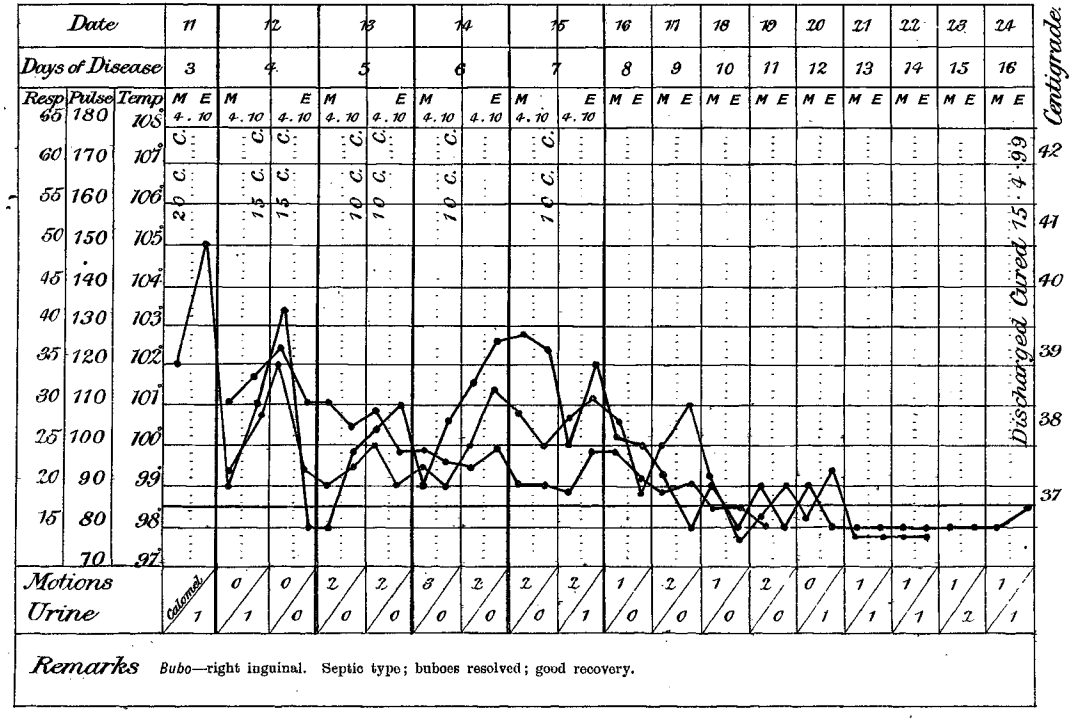
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

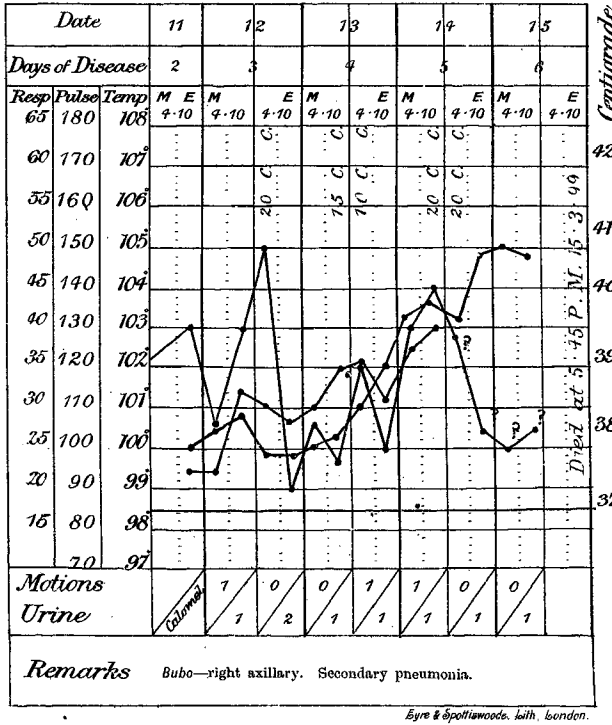
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—11th March 1899, at 4.10 p.m.
General Number—999 *DIAGNOSIS*—Plague.
Name—BIPTEE MEHEGE. *Sex*—Male. *Age*—20.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—3 Days.



Remarks *Bubo*—right inguinal. Septic type; buboes resolved; good recovery.

21. *Date of Admission*—11th March 1899, at 6.45 p.m.
General Number—1003. *DIAGNOSIS*—Plague.
Name—DAGDOO SADOO. *Sex*—Male. *Age*—30.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—2 Days.



Remarks *Bubo*—right axillary. Secondary pneumonia.

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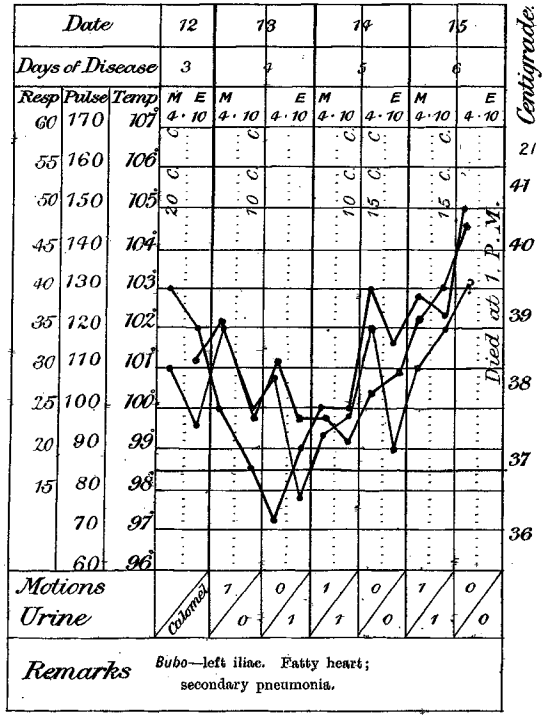
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

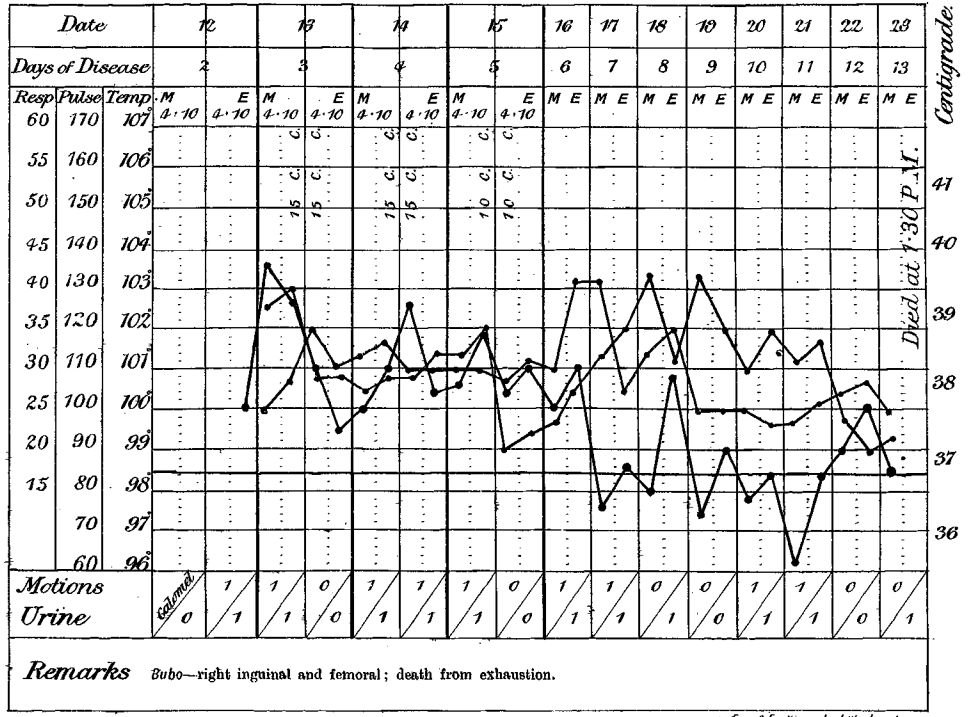
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

22. *Date of Admission*—12th March 1899, at 3.30 p.m.
General Number—1013. *DIAGNOSIS*—Plague.
Name—LAWRENCE CAITAN. *Sex*—Male. *Age*—45.
Occupation—Clerk. *Caste*—Christian.
Previous Duration—3 Days.



23. *Date of Admission*—12th March 1899, at 10.25 p.m.
General Number—1017. *DIAGNOSIS*—Plague
Name—KESOO LALLA. *Sex*—Male. *Age*—60.
Occupation—Domestic Servant. *Caste*—Hindu.
Previous Duration—2 Days.



Eyre & Spottiswoode. Lith, London.

APPENDIX No. LXIII. (*See Question No.* 20,938.)

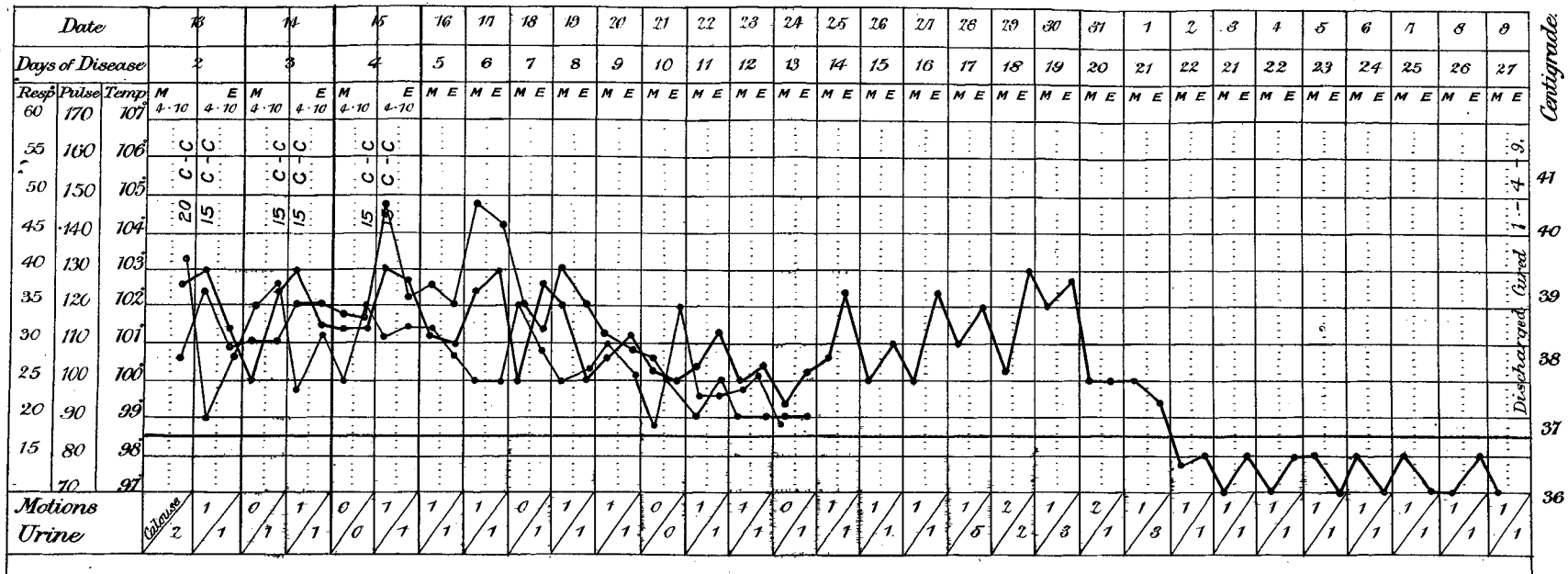
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

24. *Date of Admission*—13th March 1899, at 9 a.m. *General Number*—1019. *DIAGNOSIS*—Plague.

Name—PANDOO JANOO. *Sex*—Male. *Age*—20. *Occupation*—Labourer. *Caste*—Hindu. *Previous Duration*—2 Days.



Remarks *Bubo*—right inguinal; plague bronchitis; arthritis; buboes resolved; good recovery.

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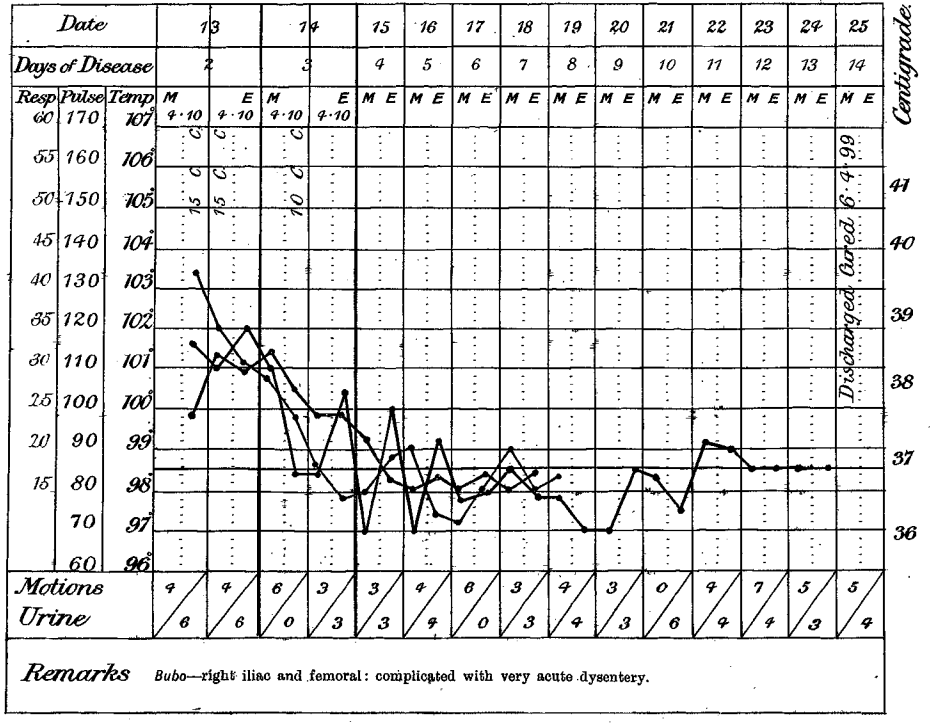
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

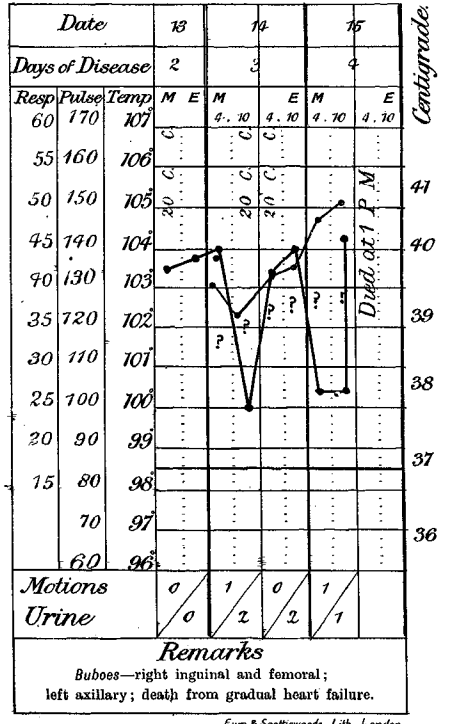
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

25. *Date of Admission*—13th March 1899, at 9.55 a.m.
General Number—1023. *DIAGNOSIS*—Plague.
Name—BHOWANISHANKER H. *Sex*—Male. *Age*—17.
Occupation—Bookseller. *Caste*—Hindu.
Previous Duration—2 Days.



26. *Date of Admission*—13th March 1899, at 5 p.m.
General Number—1034. *DIAGNOSIS*—Plague.
Name—NANA BHANA. *Sex*—Male. *Age*—25.
Occupation—Syce. *Caste*—Hindu.
Previous Duration—2 Days.



Eyre & Spottiswoode. Lith., London.

APPENDIX No. LXIII. *(See Question No. 20,938.)*

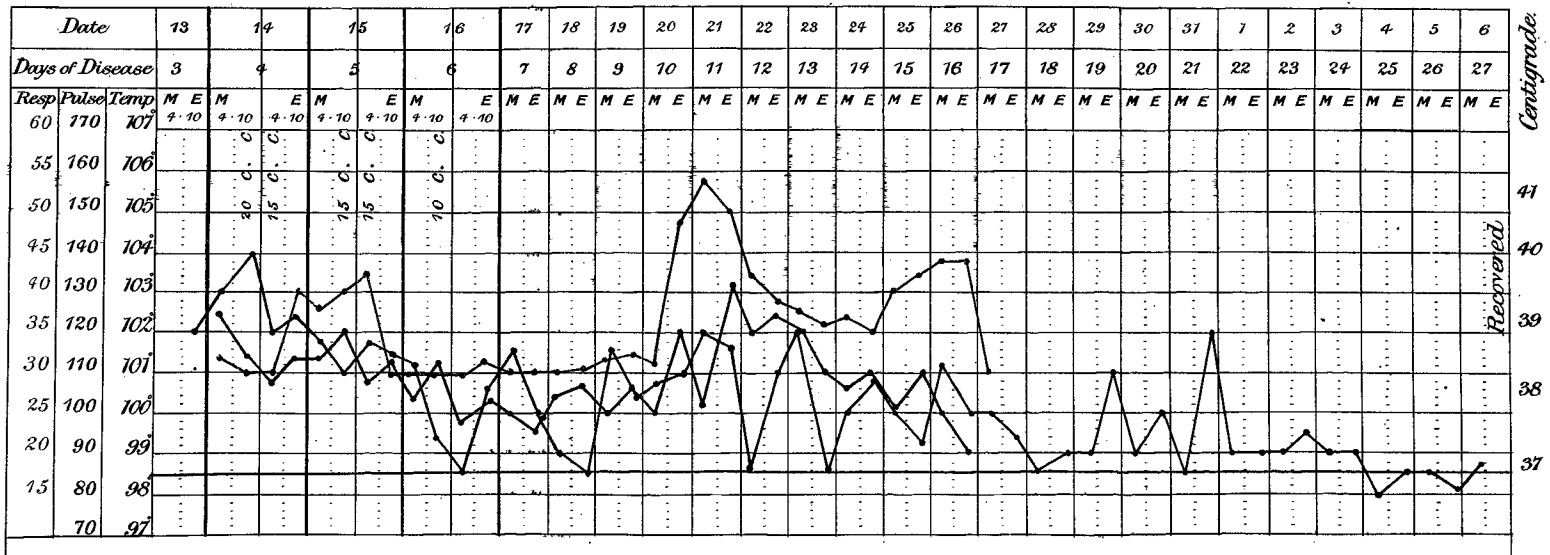
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

27. *Date of Admission*—13th March 1899, at 7.15 p.m. *General Number*—1035. *DIAGNOSIS*—Plague.

Name—GUNIA SADOO. *Sex*—Male. *Age*—35. *Occupation*—Beggar. *Caste*—Hindu. *Previous Duration*—3 Days.



Remarks *Bubo*—left femoral; secondary pneumonia; recovery; bubo resolved.

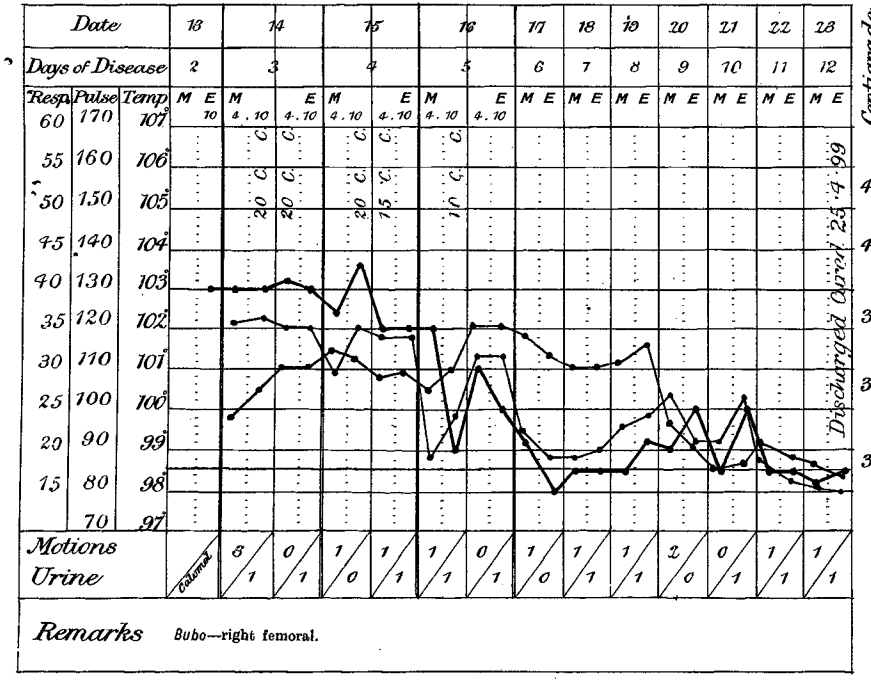
Eyre & Spottiswoode. Lith, London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

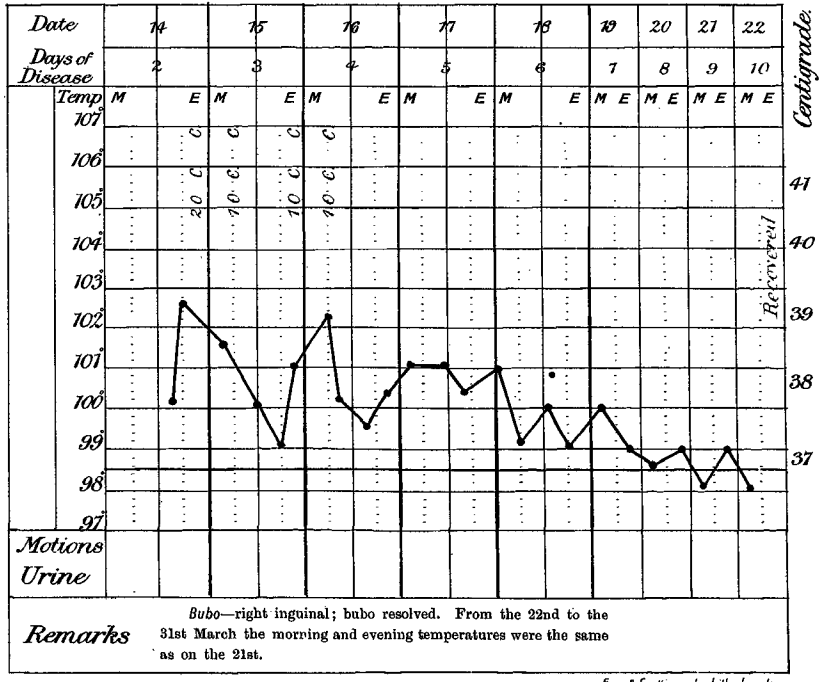
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

28. *Date of Admission*—13th March 1899, at 9 p.m.
General Number—1036. *DIAGNOSIS*—Plague.
Name—FRANCIS XAVIOR F. *Sex*—Male. *Age*—20.
Occupation—Fitter. *Caste*—Christian.
Previous Duration—2 Days.



29. *Date of Admission*—14th March 1899.
General Number—1048. *DIAGNOSIS*—Plague.
Name—APPA BHAU. *Sex*—Male. *Age*—20.
Occupation—Mill Hand. *Caste*—Hindu.
Previous Duration—2 Days.



Byrne & Spottiswoode, Lith., London.

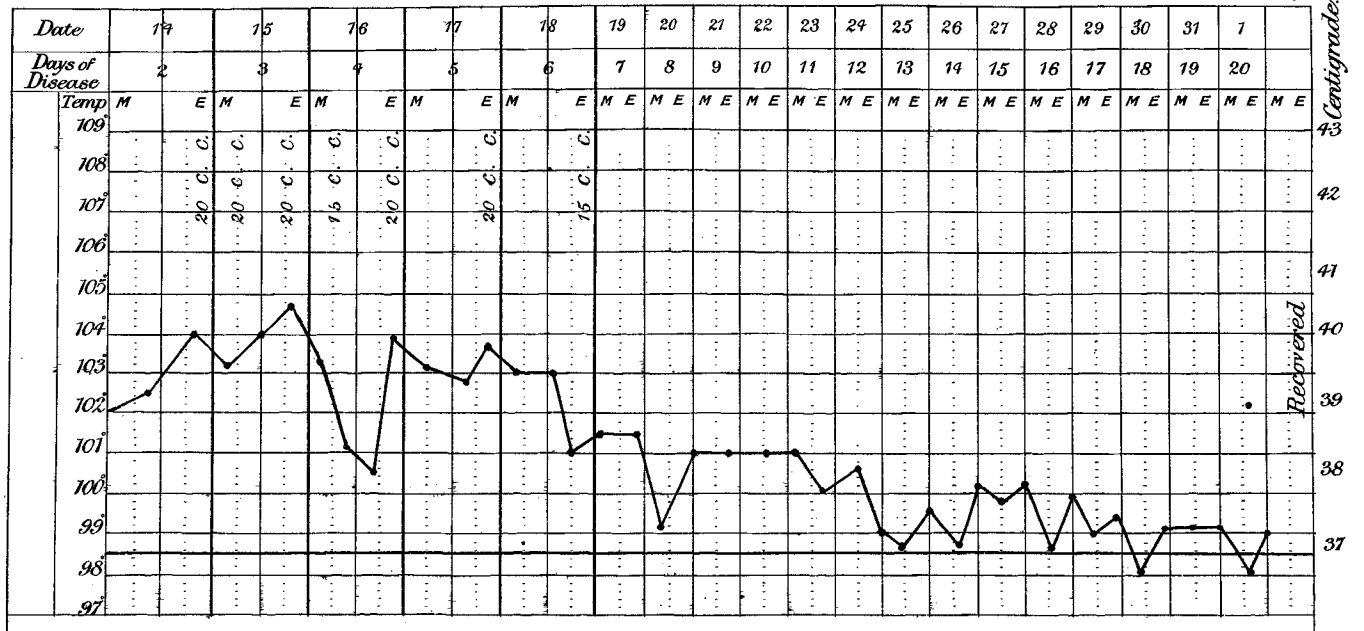
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

30. *Date of Admission*—14th March 1899. *General Number*—1050. *DIAGNOSIS*—Plague.

Name—SHIVA KONDAJI. *Sex*—Male. *Age*—35. *Occupation*—Coolie. *Caste*—Hindu. *Previous Duration*—2 Days.



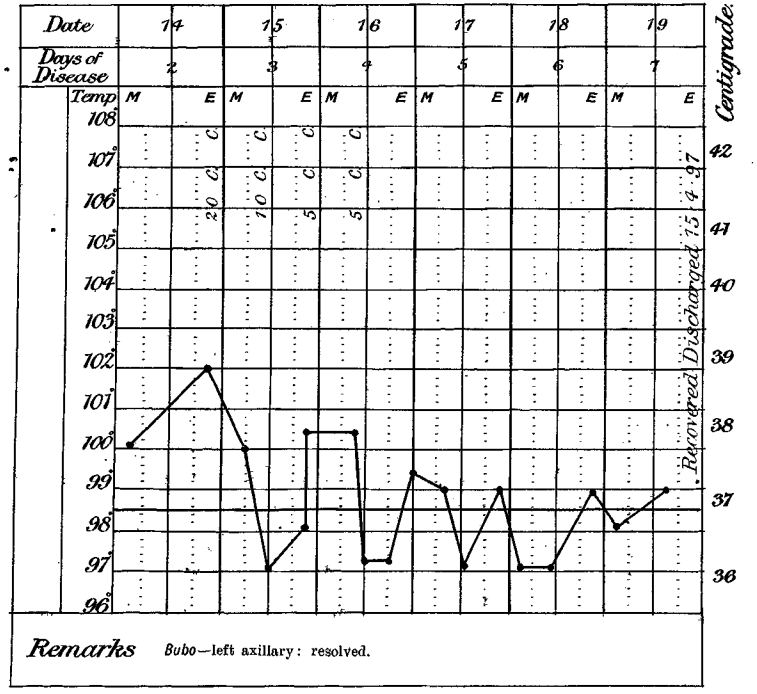
Eyre & Spottiswoode, Lith, London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

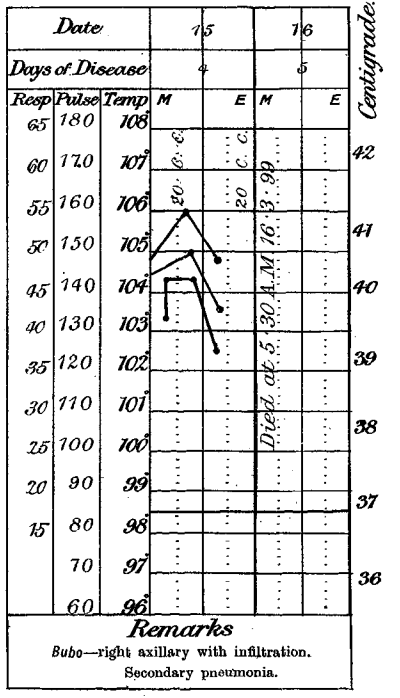
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

31. *Date of Admission*—14th March 1899.
General Number—1053. *DIAGNOSIS*—Plague.
Name—CYPRIAN F. *Sex*—Male. *Age*—25.
Occupation—Cook. *Caste*—Christian.
Previous Duration—2 Days.



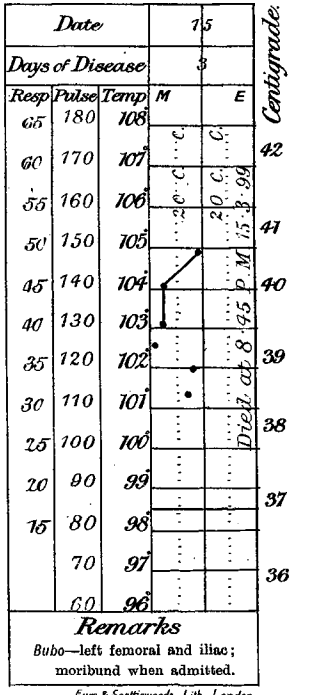
Remarks *Bubo*—left axillary: resolved.

32. *Date of Admission*—15th March 1899, at 10.20 a.m.
General Number—1064. *DIAGNOSIS*—Plague.
Name—SOOKAI JAHIRI. *Sex*—Male. *Age*—30.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—4 Days.



Remarks
Bubo—right axillary with infiltration.
Secondary pneumonia.

33. *Date of Admission*—15th March 1899, at 10.25 a.m.
General Number—1065. *DIAGNOSIS*—Plague.
Name—JOHN DE COSTA. *Sex*—Male. *Age*—30.
Occupation—Cook. *Caste*—Christian.
Previous Duration—3 Days.



Remarks
Bubo—left femoral and iliac; moribund when admitted.

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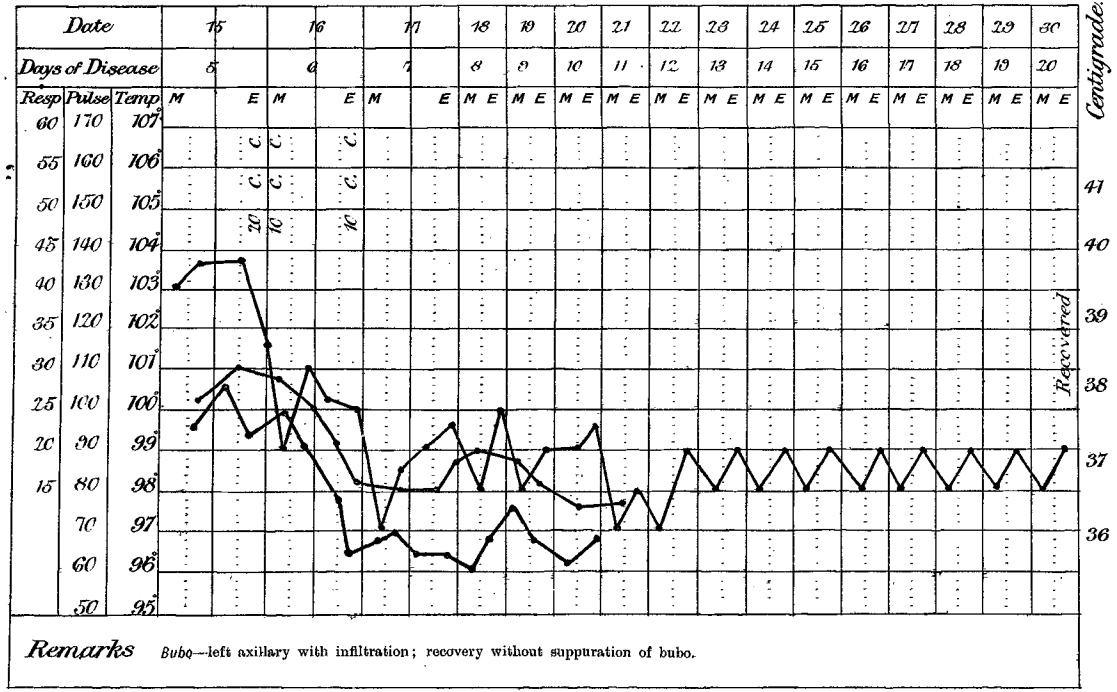
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

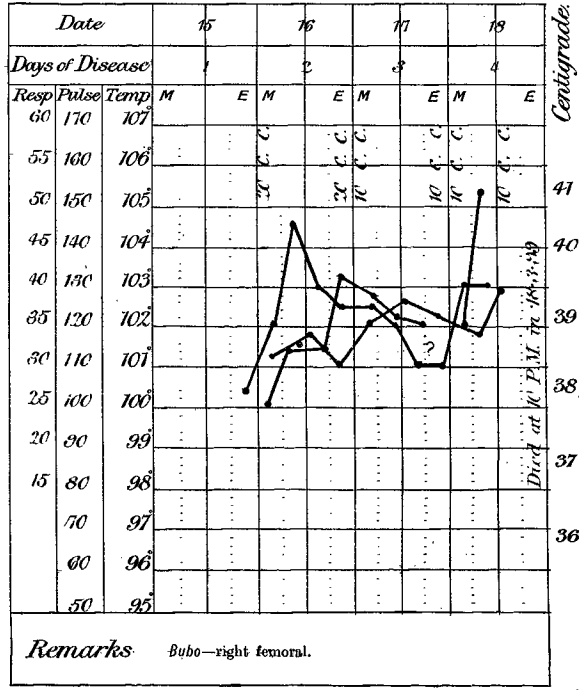
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—15th March 1899, at 10.45 a.m.
General Number—1066. *DIAGNOSIS*—Plague.
Name—DERIA ISRA. *Sex*—Male. *Age*—23.
Occupation—Domestic Servant. *Caste*—Hindu.
Previous Duration—5 Days.



Remarks *Bubo*—left axillary with infiltration; recovery without suppuration of bubo.

35. *Date of Admission*—15th March 1899, at 8.50 p.m.
General Number—1080. *DIAGNOSIS*—Plague.
Name—CYPRIAN ALFONSO. *Sex*—Male. *Age*—40.
Occupation—Broker. *Caste*—Christian.
Previous Duration—1 Day.



Remarks *Bubo*—right femoral.

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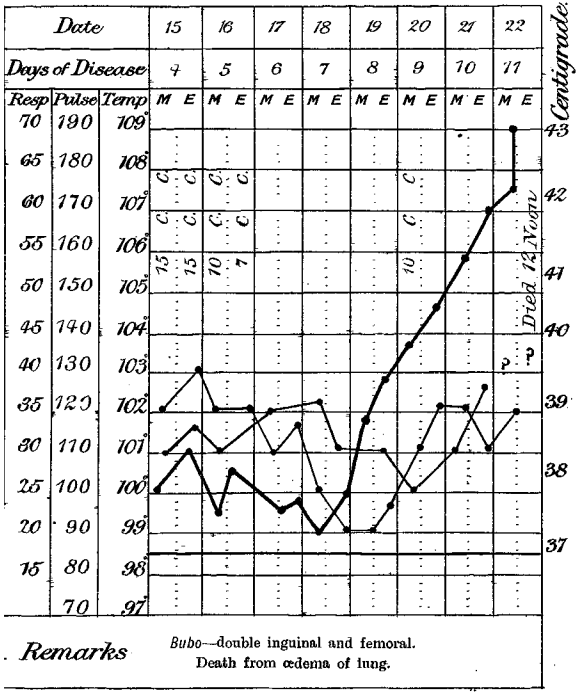
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

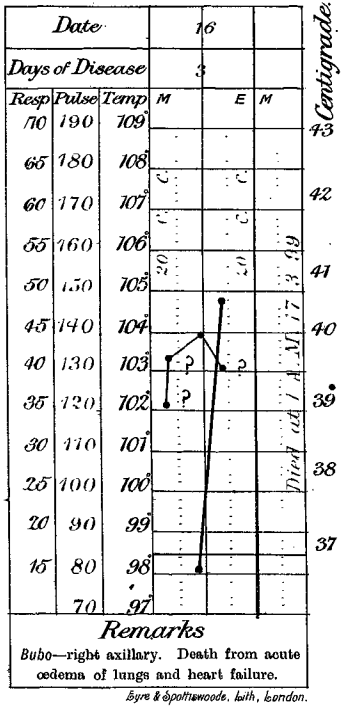
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—15th March 1899, at
General Number— *DIAGNOSIS*—Plague.
Name—MRS. S. *Sex*—Female. *Age*—56.
Occupation— *Caste*—Parsee.
Previous Duration—4 Days.



37. *Date of Admission*—16th March 1899, at 7.15 a.m.
General Number—1082. *DIAGNOSIS*—Plague.
Name—MAMIAJI YESHRAM. *Sex*—Male. *Age* 15.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—3 Days.



Eyre & Spottiswoode, Lith., London.

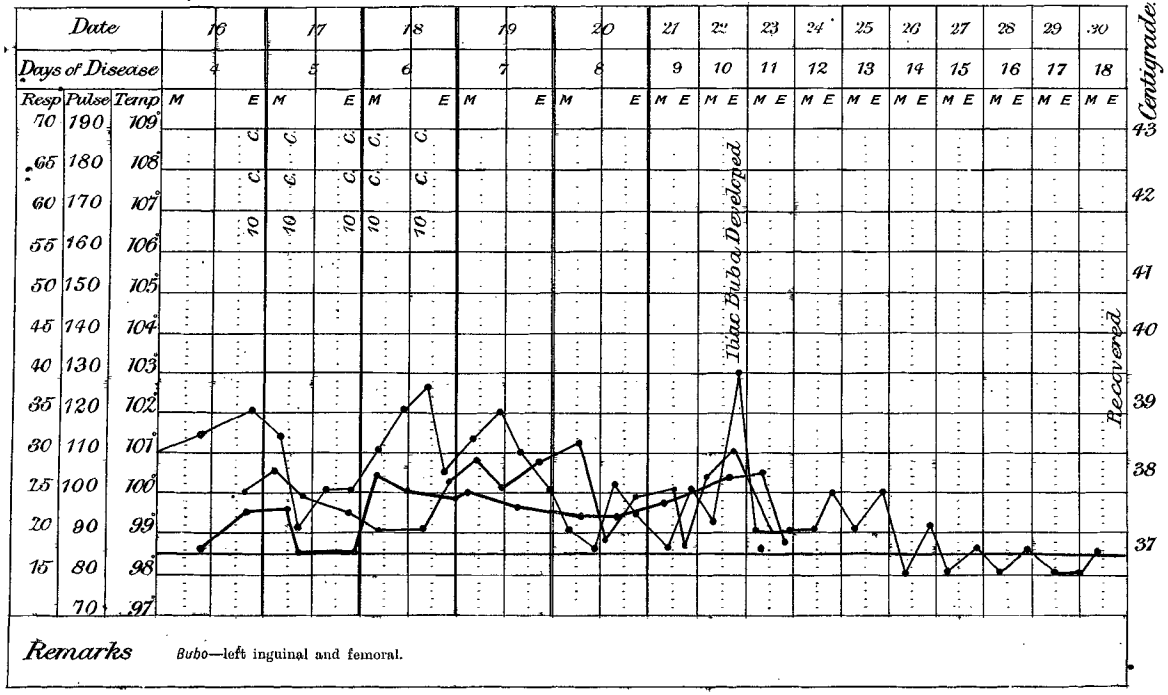
APPENDIX No. LXIII. (*See Question No.* 20,938.)

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

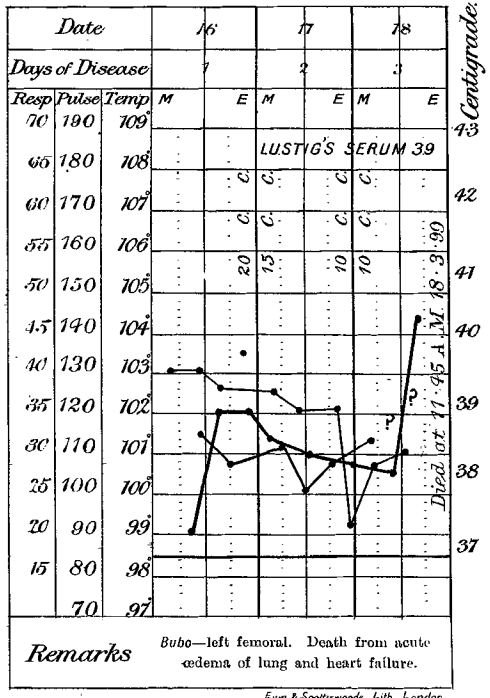
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

Date of Admission—16th March 1899, at 10.20 a.m.
General Number—1088. *DIAGNOSIS*—Plague.
Name—BHAGWANDAS RAGHOODAS. *Sex*—Male. *Age*—30.
Occupation—Beggar. *Caste*—Hindu.
Previous Duration—4 Days.



Remarks *Bubo*—left inguinal and femoral.

39. *Date of Admission*—16th March 1899, at 11.30 a.m.
General Number—1094. *DIAGNOSIS*—Plague.
Name—DOMINGO CAETAN. *Sex*—Male. *Age*—60.
Occupation—Cook. *Caste*—Christian.
Previous Duration—1 Day.



Remarks *Bubo*—left femoral. Death from acute œdema of lung and heart failure.

Eyre & Spottiswoode, lith., London.

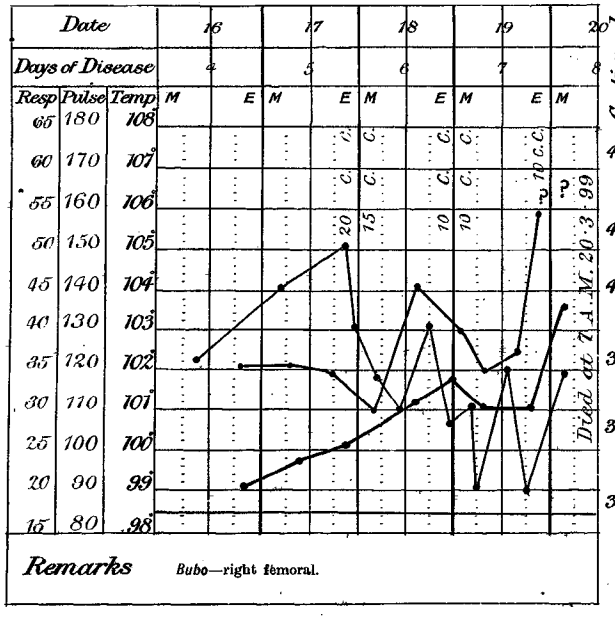
APPENDIX No. LXIII. (*See Question No.* 20,938.)

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

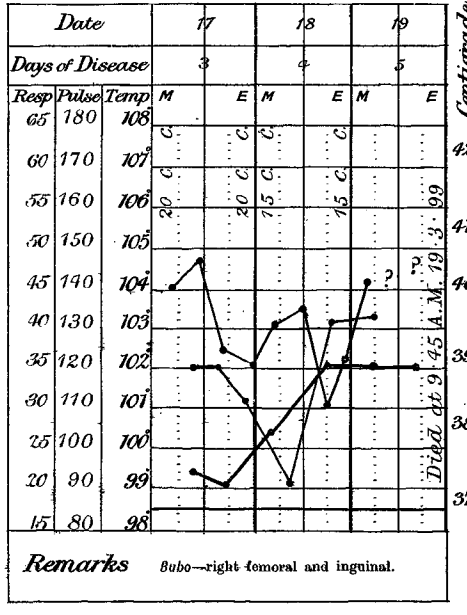
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

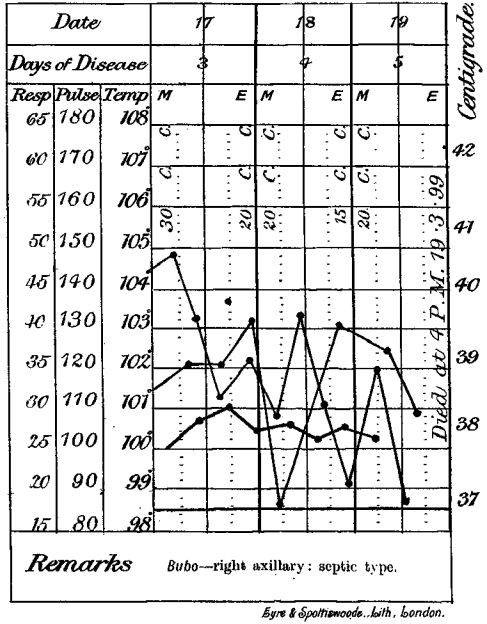
Date of Admission—16th March 1899, at 10.10 p.m.
General Number—1099. *DIAGNOSIS*—Plague.
Name—GANDARAM KARAMCHAND. *Sex*—Male. *Age*—30.
Occupation—Merchant. *Caste*—Hindu.
Previous Duration—4 Days.



41. *Date of Admission*—17th March 1899, at 8 a.m.
General Number—1101. *DIAGNOSIS*—Plague.
Name—KRISHNA VITHU *Sex*—Male. *Age*—40.
Occupation—Domestic Servant. *Caste*—Hindu.
Previous Duration—3 Days.



42. *Date of Admission*—17th March 1899, at 9.10 a.m.
General Number—1103. *DIAGNOSIS*—Plague.
Name—COSME DAMIEN DE SA. *Sex*—Male. *Age*—23.
Occupation—Billiard Marker. *Caste*—Christian.
Previous Duration—3 Days.



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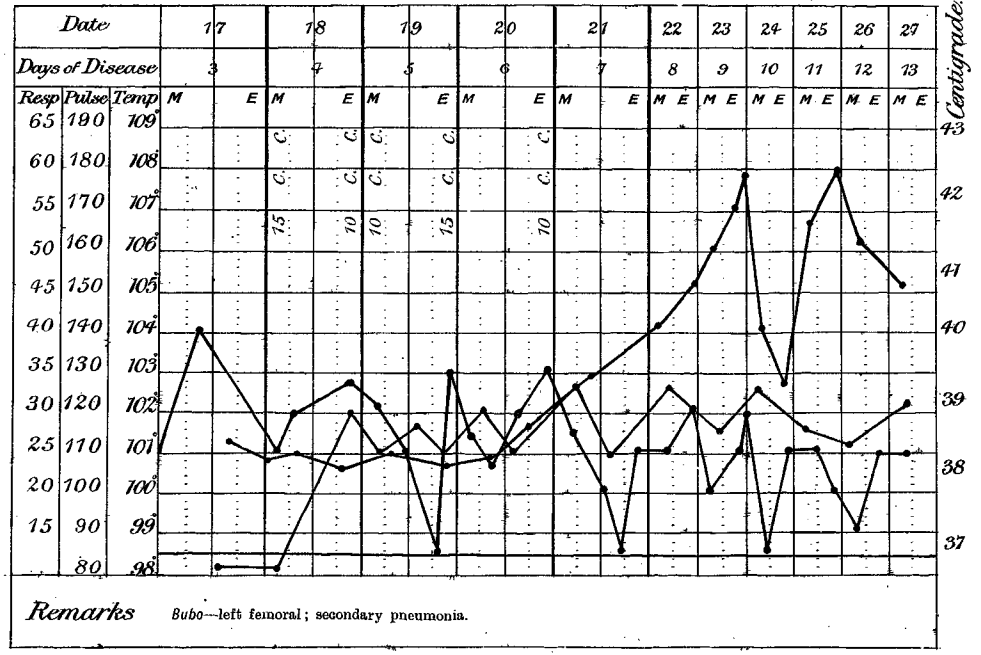
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

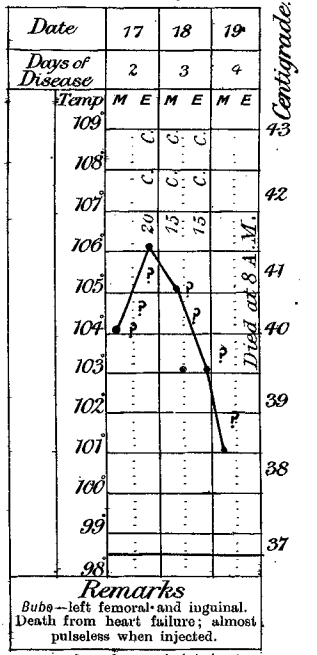
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

43. *Date of Admission*—17th March 1899, at 10.10 a.m.
General Number—1104. *DIAGNOSIS*—Plague.
Name—BABAJI ZORA. *Sex*—Male. *Age*—40.
Occupation—Barber. *Caste*—Hindu.
Previous Duration—3 Days.



Remarks *Bubo*—left femoral; secondary pneumonia.

44. *Date of Admission*—17th March 1899.
General Number— *DIAGNOSIS*—Plague.
Name—Miss J. B. S. *Sex*—Female. *Age*—16.
Occupation— *Caste*—Parsee.
Previous Duration—2 Days.



Remarks
Bubo—left femoral and inguinal.
Death from heart failure; almost pulseless when injected.

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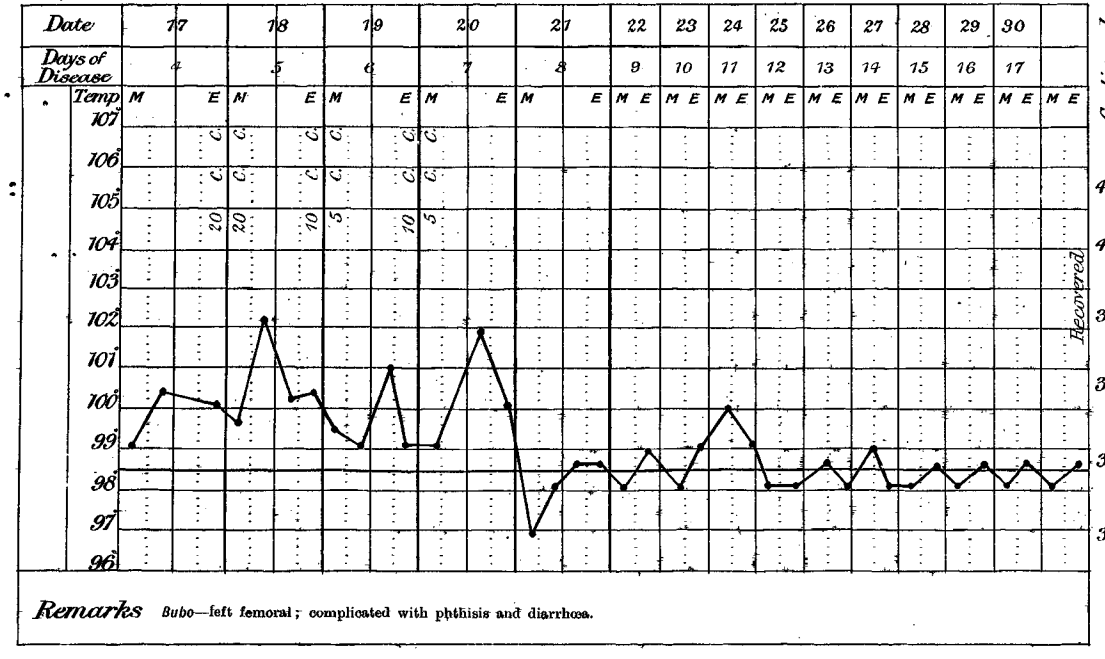
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

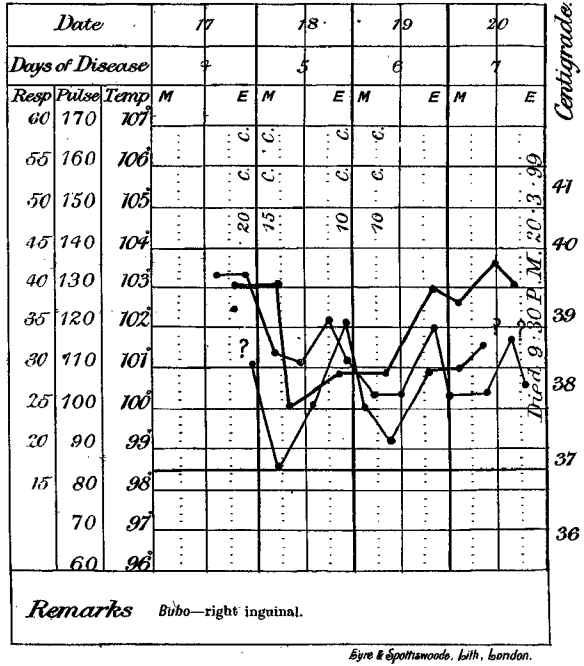
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

45. *Date of Admission*—17th March 1899.
General Number—1112. *DIAGNOSIS*—Plague.
Name—Mrs. MOSES. *Sex*—Female. *Age*—30.
Occupation—Nurse. *Caste*—Christian.
Previous Duration—4 Days.



Remarks *Bubo*—left femoral; complicated with phthisis and diarrhœa.

46. *Date of Admission*—17th March 1899, at 6.10 p.m.
General Number—1116. *DIAGNOSIS*—Plague.
Name—WALLABH PREMA. *Sex*—Male. *Age*—40.
Occupation—Groom. *Caste*—Hindu.
Previous Duration—4 Days.



Remarks *Bubo*—right inguinal.

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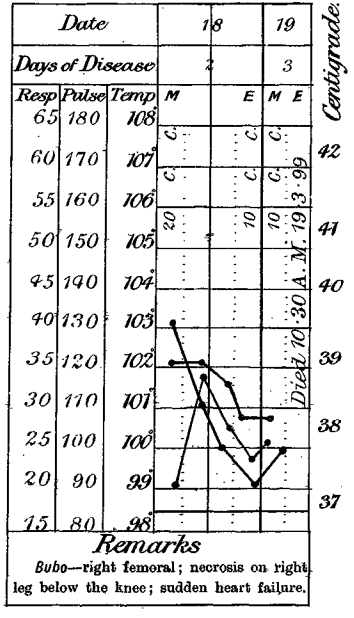
APPENDIX No. LXIII. (*See Question No.* 20,938.)

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

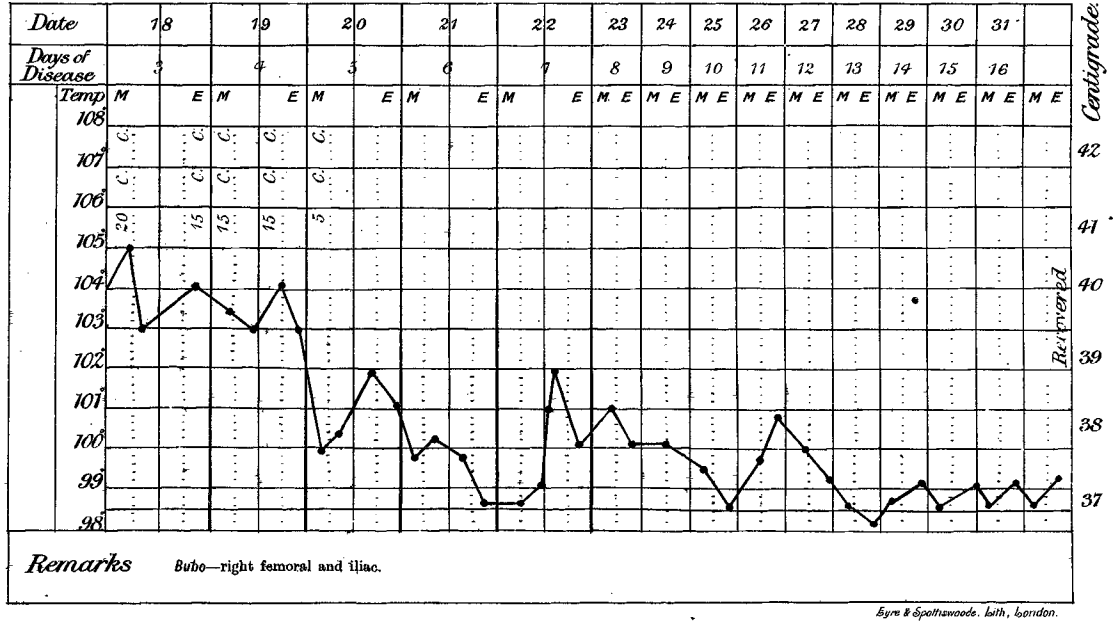
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

47. *Date of Admission*—18th March 1899.
General Number—1117. *DIAGNOSIS*—Plague.
Name—PETER FERNANDES. *Sex*—Male. *Age*—30.
Occupation—Butler. *Caste*—Christian.
Previous Duration—2 Days.



48. *Date of Admission*—18th March 1899.
General Number—1118. *DIAGNOSIS*—Plague.
Name—MARUTI GANOO. *Sex*—Female. *Age*—20.
Occupation—Nil. *Caste*—Hindu.
Previous Duration—3 Days.



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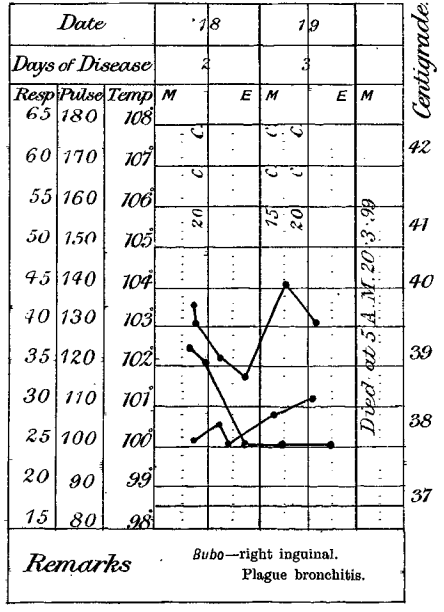
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

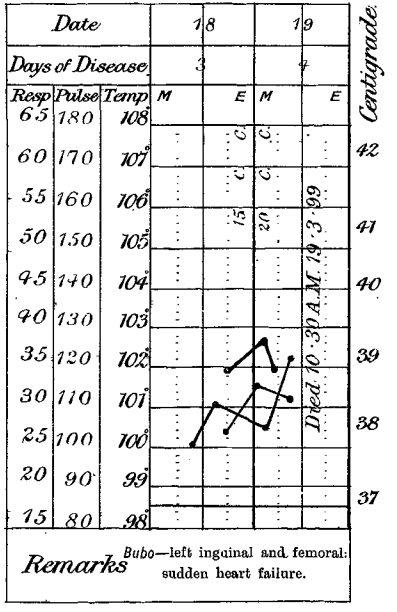
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

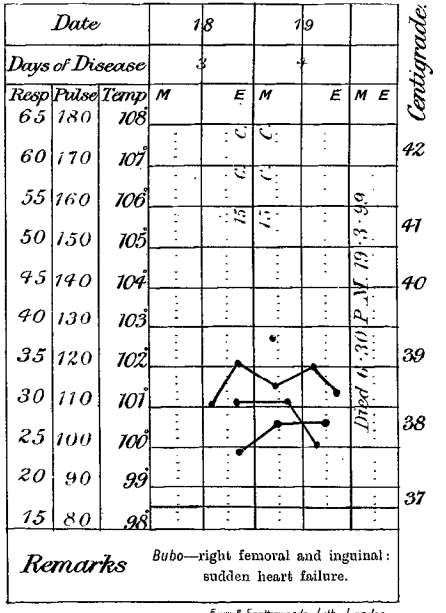
49. *Date of Admission*—18th March 1899.
General Number—1126. *DIAGNOSIS*—Plague.
Name—SAVATRI SAMDA. *Sex*—Female. *Age*—25.
Occupation—Nil. *Caste*—Hindu.
Previous Duration—2 Days.



50. *Date of Admission*—18th March 1899.
General Number—1127. *DIAGNOSIS*—Plague.
Name—A. S. LOBO. *Sex*—Male *Age*—60.
Occupation—Cook. *Caste*—Christian.
Previous Duration—3 Days.



51. *Date of Admission*—18th March 1899.
General Number—1128. *DIAGNOSIS*—Plague.
Name—SHEICK MADAR. *Sex*—Male. *Age*—30.
Occupation—Malee. *Caste*—Muhammadan.
Previous Duration—3 Days.



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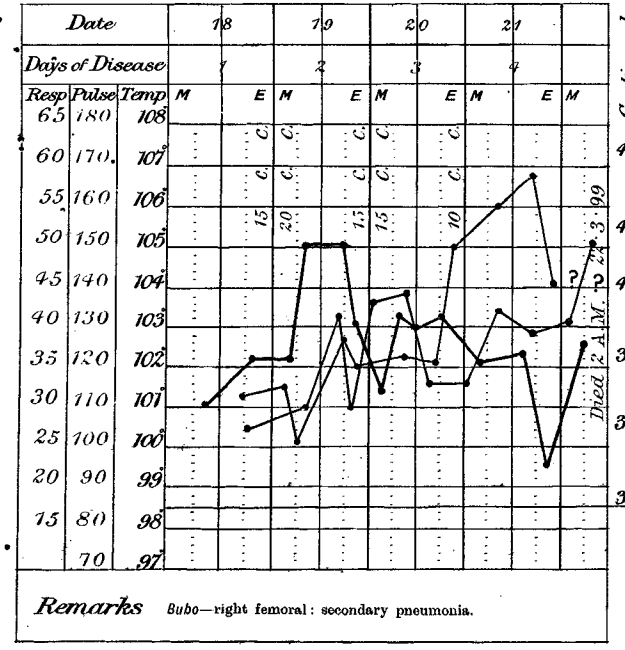
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

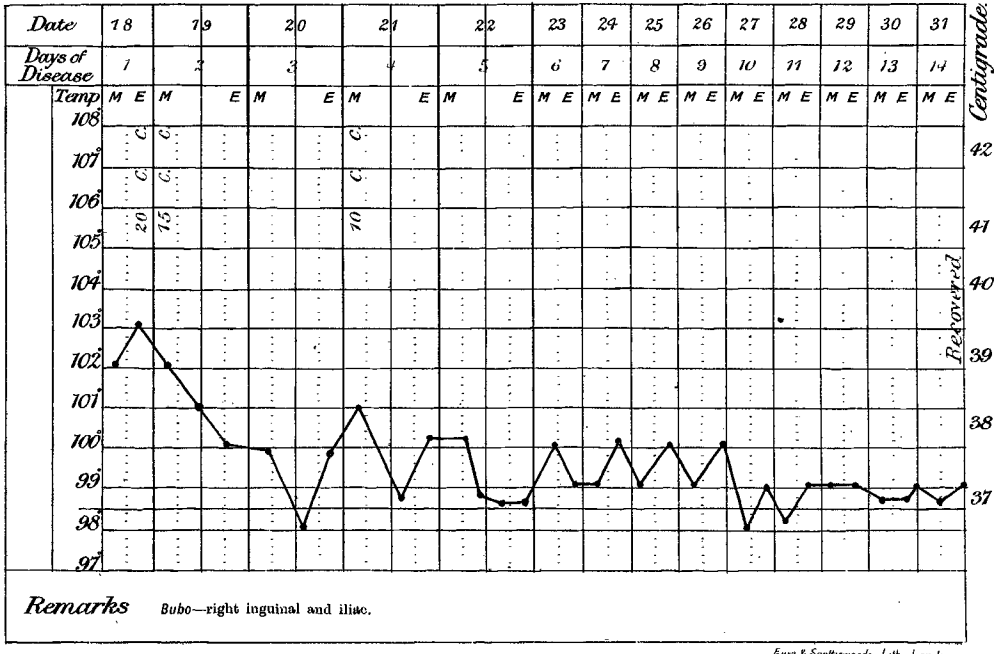
CLINICAL CHARTS OF PLAGUE CASES TREATED WITH LUSTIG'S SERUM.

52. *Date of Admission*—18th March 1899.
General Number—1135. *DIAGNOSIS*—Plague.
Name—P. S. DE COSTA. *Sex*—Male. *Age*—42.
Occupation—Baker. *Caste*—Christian.
Previous Duration—1 Day.



Remarks *Bubo*—right femoral: secondary pneumonia.

53. *Date of Admission*—18th March 1899.
General Number—1132. *DIAGNOSIS*—Plague.
Name—G. F. G. *Sex*—Male. *Age*—35.
Occupation—Nil. *Caste*—Christian.
Previous Duration—1 Day.



Remarks *Bubo*—right inguinal and iliac.

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Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES.

1. *Date of Admission*—5th February 1898, at 12.35 p.m. *General Number*—1011. *DIAGNOSIS*—Plague.

Name—MAROOTI RAMJEE. *Sex*—Male. *Age*—35. *Occupation*—Goldsmith. *Caste*—Hindu. *Previous Duration*—2 Days.

Date	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5
Days of Disease	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Resp / *Pulse* / *Temp*	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E
Motions	1	1	1	2	1	0	1	2	2	1	1	1	1	3	0	1	1	1	1	3	1	1	1	0	1	1	1	1
Urine	1	0	0	1	0	0	1	1	0	1	1	1	2	1	0	0	2	0	1	1	1	1	1	3	2	1	1	1	1

Remarks Bubo—left femoral.

Centigrade. *Discharged. Cured 5.3.98*

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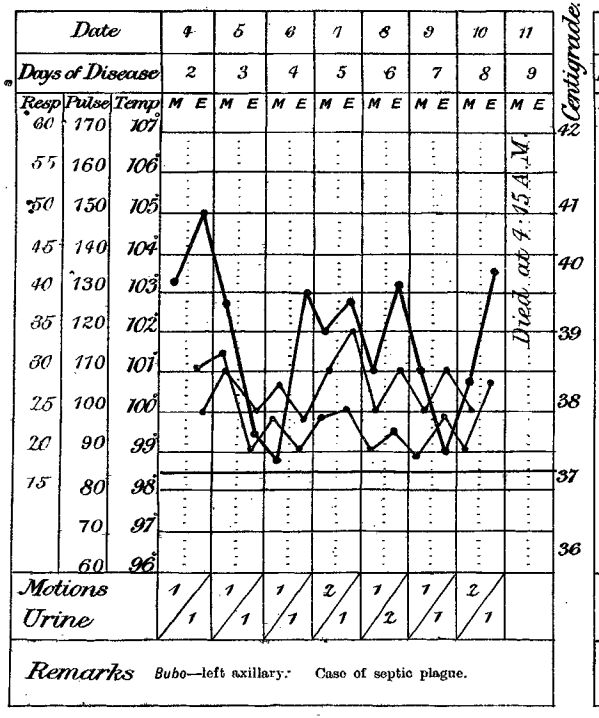
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

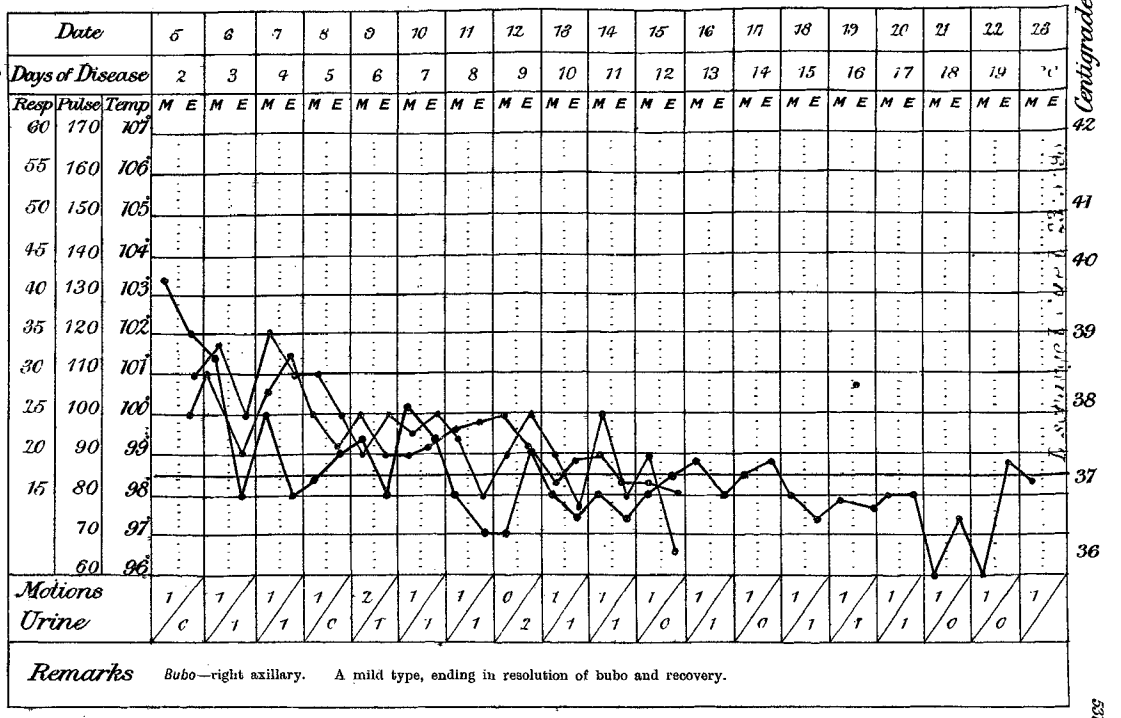
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES.

2. *Date of Admission*—4th March 1898, at 9.55 a.m.
General Number—1922. *DIAGNOSIS*—Plague.
Name—YESSOO, wife of GOVIND. *Sex*—Female. *Age*—20 years.
Occupation—Nil. *Caste*—Hindu.
Previous Duration.—2 Days.



3. *Date of Admission*—5th March 1898, at 10.25 a.m.
General Number—1957. *DIAGNOSIS*—Plague.
Name—IZABEL, d. of ROSARIO. *Sex*—Female. *Age*—5 years.
Occupation—Nil. *Caste*—Christian.
Previous Duration—2 Days.



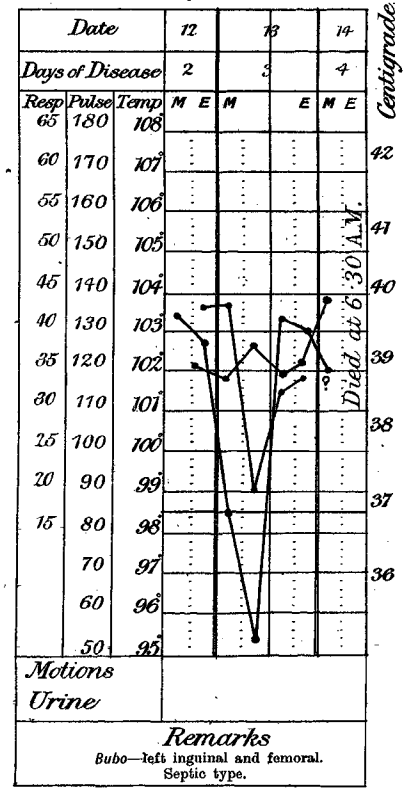
Eyre & Spottiswoode. Lith, London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

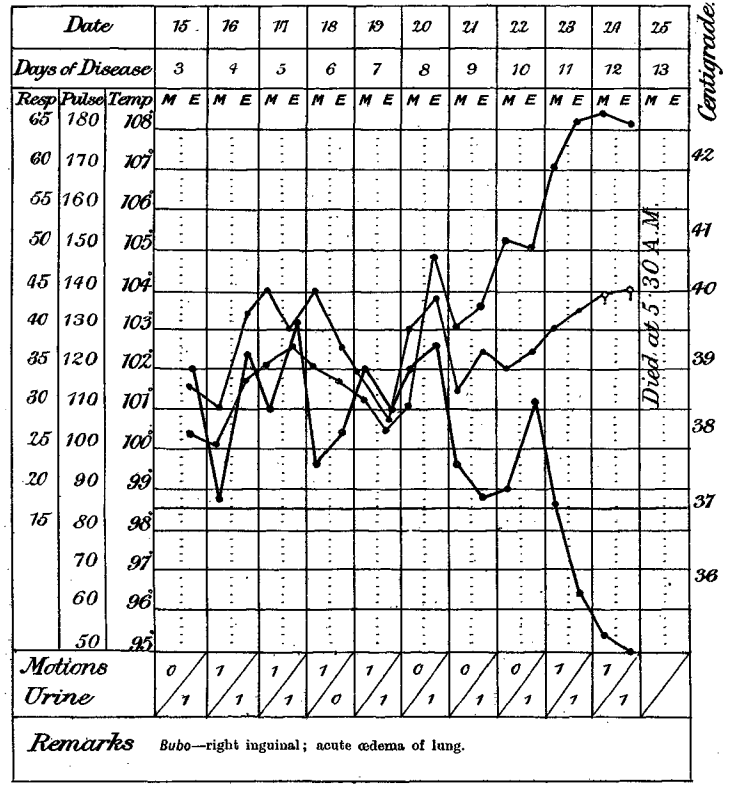
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES.

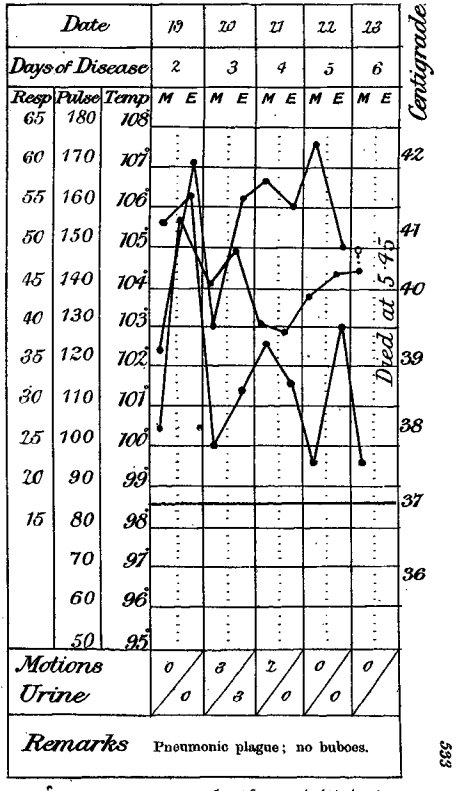
4. *Date of Admission*—12th March 1898, at 10.40 a.m.
General Number—2114. *DIAGNOSIS*—Plague.
Name—NARSOO BURMAJI. *Sex*—Male. *Age*—45.
Occupation—Biscuit Seller. *Caste*—Hindu.
Previous Duration—2 Days.



5. *Date of Admission*—15th March 1898, at 1.45 p.m.
General Number—2205. *DIAGNOSIS*—Plague.
Name—JAMNABAI, wife of WAMON. *Sex*—Female. *Age*—25.
Occupation—Nil. *Caste*—Hindu.
Previous Duration—3 Days.



6. *Date of Admission*—19th March 1898, at 11 a.m.
General Number—2287. *DIAGNOSIS*—Plague.
Name—RITA FERNANDEZ. *Sex*—Female. *Age*—15.
Occupation—Nil. *Caste*—Christian.
Previous Duration—2 Days.



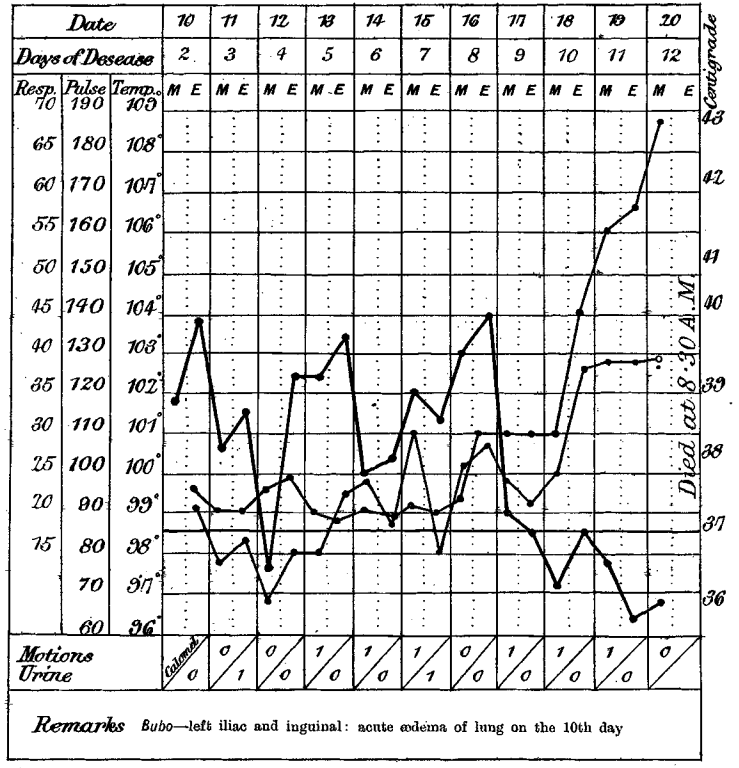
Eyre & Spottiswoode, Lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

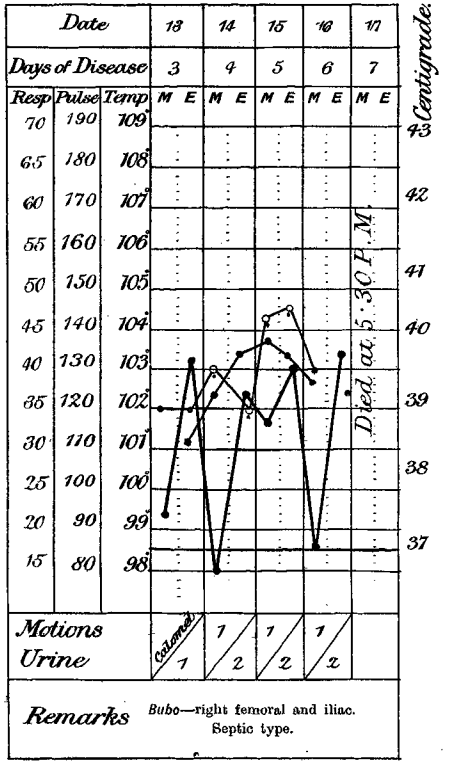
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES.

7. *Date of Admission*—10th February 1899, at 9.40 a.m.
General Number—424. *DIAGNOSIS*—Plague.
Name—BHIKHA VITHOO. *Sex*—Male. *Age*—20.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—2 Days.



8. *Date of Admission*—13th February 1899, at 9.5 a.m.
General Number—473. *DIAGNOSIS*—Plague.
Name—DHONDI, wife of MAHMAJI. *Sex*—Female. *Age*—22.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—3 Days.



Eyre & Spottiswoode Lith, London.

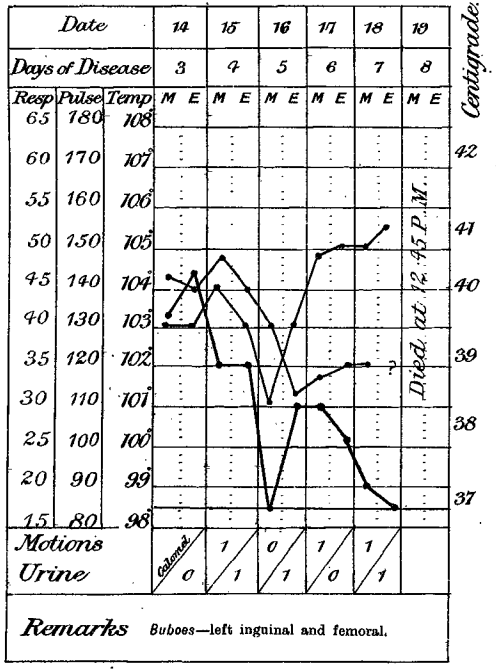
APPENDIX No. LXIV. (*See Question No.* 21,033.)

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

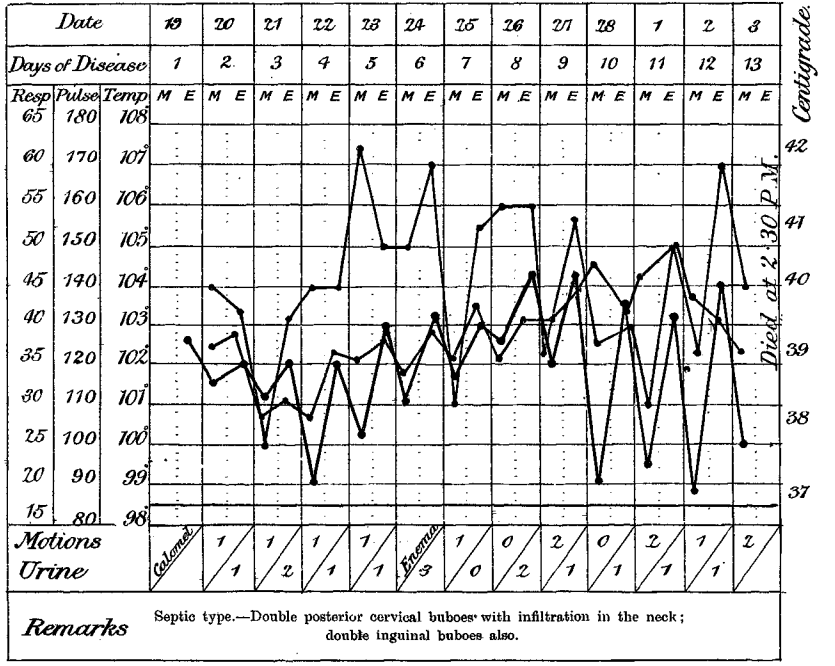
CLINICAL CHARTS OF PLAGUE CASES.

9. *Date of Admission*—14th February 1899, at 11.55 a.m.
General Number—493. *DIAGNOSIS*—Plague.
Name—LUXMI, widow of NAMA. *Sex*—Female. *Age*—35.
Occupation—Labourer. *Caste*—Hindu.
Previous Duration—3 Days.



Remarks *Buboes*—left inguinal and femoral.

10. *Date of Admission*—19th February 1899, at 7.55 a.m.
General Number—594. *DIAGNOSIS*—Plague.
Name—RUTH DE CRUZ. *Sex*—Female. *Age*—7.
Occupation—Nil. *Caste*—Christian.
Previous Duration—1 Day.



Remarks Septic type.—Double posterior cervical buboes with infiltration in the neck; double inguinal buboes also.

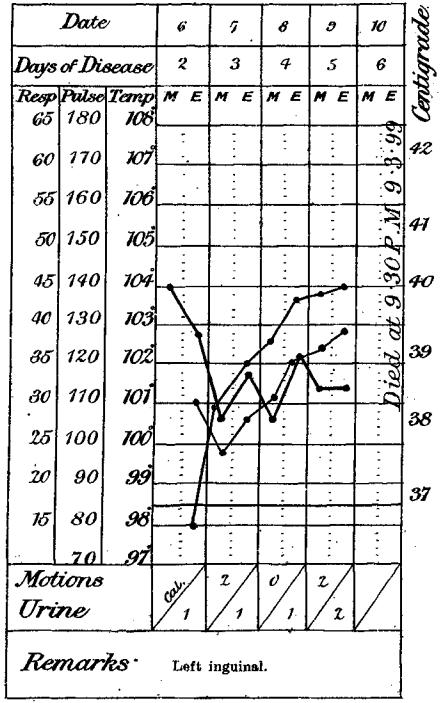
Eyre & Spottiswoode, Lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

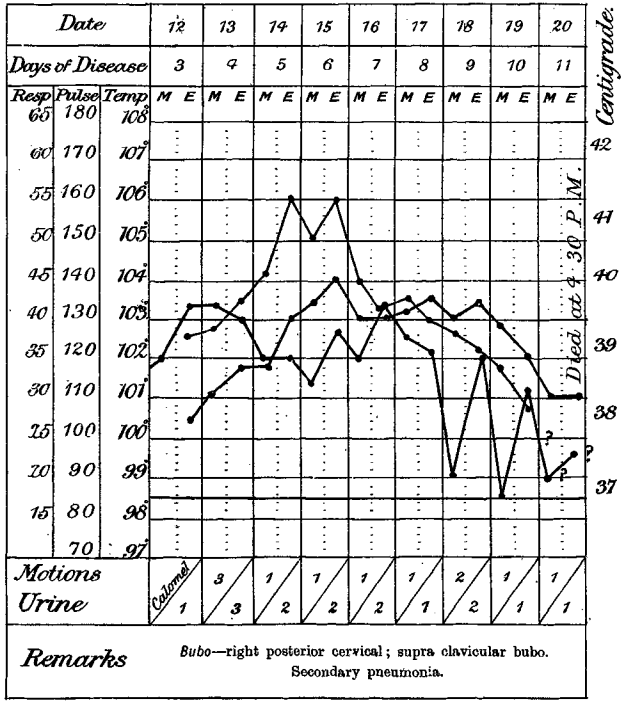
(Dr. CHOKSY.)

CLINICAL CHARTS OF PLAGUE CASES.

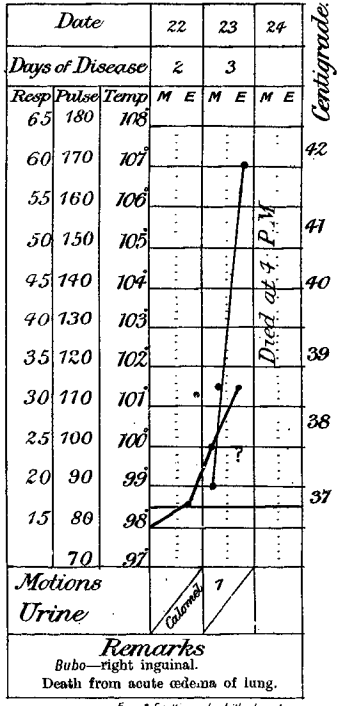
11. *Date of Admission*—6th March 1899, at 10.45 a.m.
General Number—881. *DIAGNOSIS*—Plague.
Name—RAMA KEDARI. *Sex*—Male. *Age*—22.
Occupation—Mill Hand. *Caste*—Hindu.
Previous Duration—2 Days.



12. *Date of Admission*—12th March 1899, at 9.15 a.m.
General Number—1007. *DIAGNOSIS*—Plague.
Name—VISNOO RAOJEE. *Sex*—Male. *Age*—18.
Occupation—Butler. *Caste*—Hindu.
Previous Duration—3 Days.



13. *Date of Admission*—22nd March 1899, at 5.30 p.m.
General Number—1204. *DIAGNOSIS*—Plague.
Name—FRANCIS DE SILVA. *Sex*—Male. *Age*—30.
Occupation—Tailor. *Caste*—Christian.
Previous Duration—2 Days.



Eyre & Spottiswoode, Lith., London.

Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF CASES OF PLAGUE AND RELAPSING FEVER.

14. *Date of Admission*—7th February 1897. *General Number*—1109.

Name—VITHABAI, wife of ATMARAM. Female. *Age*—70. Hindu. *Occupation*—Nil.

Date	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Days of Disease	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Resp / Pulse / Temp	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E
Motions / Urine	2	0/1	1/0	1/1	1/1	0/1	1/2	4/0	0/1	1/1	3/1	2/1	0/2	1

Centigrade: 41, 40, 39, 38, 37, 36, 35

Died at 4·30 P.M.

Remarks: *Bubo*—right inguinal and femoral. A mixed case of relapsing fever and plague; patient admitted after the critical fall of temp. on the 5th day; temp. remaining sub-normal; death from secondary pneumonia.

15. *Date of Admission*—7th February 1898. *General Number*—1088.

Name—RADHA ATMARAM. Female. *Age*—24. Hindu. *Occupation*—Nil.

Date	7	8	9	10	11	12	13	14
Days of Disease	2	3	4	5	6	7	8	9
Resp / Pulse / Temp	M E	M E	M E	M E	M E	M E	M E	M E
Motions / Urine	0/1	0/0	1/0	1/1	1/0	1/1	1/1	2/0

Centigrade: 41, 40, 39, 38, 37, 36, 35

Died at 11·30 A.M. 14·2·98

Remarks: *Bubo*—left femoral. A mixed case of relapsing fever and plague. Acute œdema of lung; death from heart failure.

Eyre & Spottiswoode. lith., London.

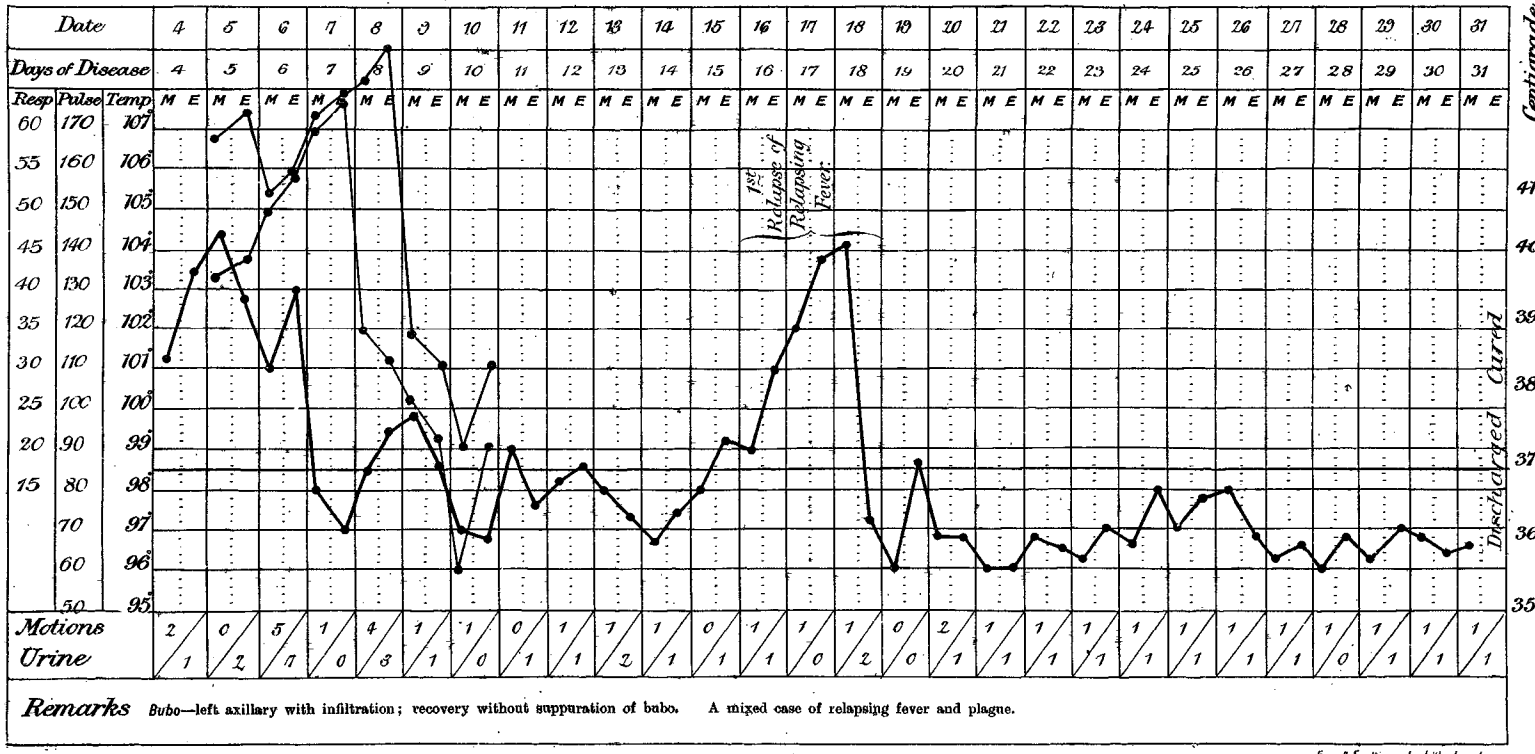
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF CASES OF PLAGUE AND RELAPSING FEVER.

16. *Date of Admission*—4th October 1898. *General Number*—3212.

Name—NAROO JOTI. Male. *Age*—35. *Caste*—Hindu. *Occupation*—Labourer.



Remarks *Bubo*—left axillary with infiltration; recovery without suppuration of bubo. A mixed case of relapsing fever and plague.

Eyre & Spottiswoode, Lith., London.

APPENDIX No. LXIV. (*See Question No.* 21,049.)

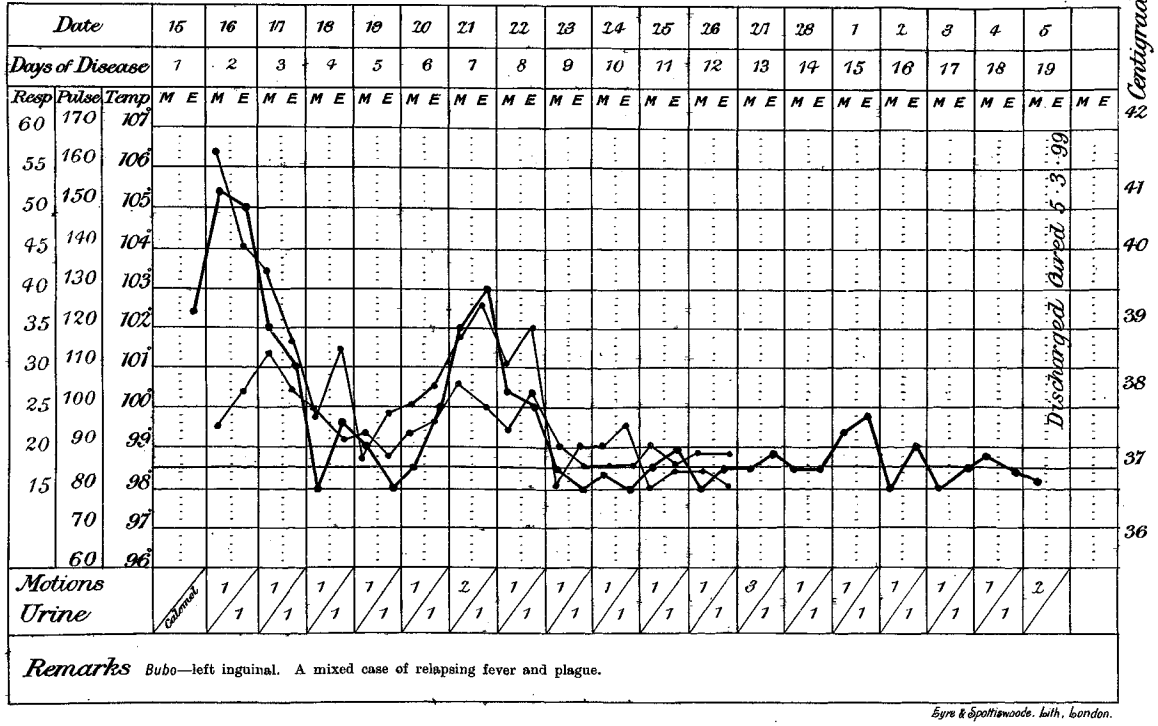
Municipal Hospital for Infectious Diseases, Arthur Road, Bombay.

(Dr. CHOKSY.)

CLINICAL CHARTS OF CASES OF PLAGUE AND RELAPSING FEVER.

17. *Date of Admission*—15th February 1899. *General Number*—522.

Name—CHANDRI LUXMOU. Female. *Age*—13. *Caste*—Hindu. *Occupation*—Mill Hand.



Eyre & Spottiswoode. Lith. London.

(See Question No. 21,034)

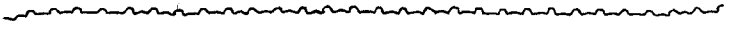
SPHYGMOGRAPHIC TRACINGS

OF PATIENTS TREATED IN THE ARTHUR ROAD HOSPITAL, BOMBAY.

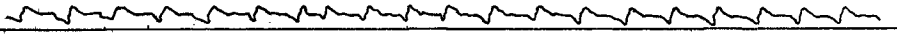
6—4—99. RAMA BALU.

24—4—99. BALTHAZAR DE SOUZA.

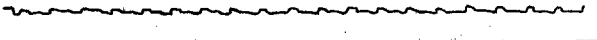
26—4—99. BALA KUSABA.



26—4—99. BHANA KHUSHAL.



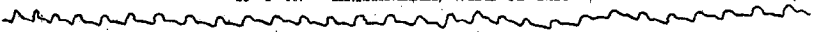
26—4—99. SAMBHU GOPAL.



26—4—99. No. 1,564.

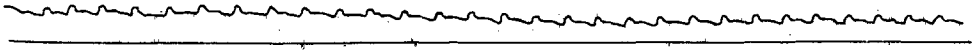
27—4—99. MAHADU BHANU.

28—4—99. KRISHNABAI, WIFE OF RAGHU.

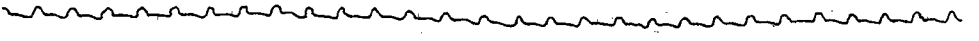


29—4—99. HIRAPA SAMBHU.

29—4—99. UPASHA KONDAJI.



30—4—99. CHANDIPARSHAD GANGAPARSHAD.



CHARTS RELATING TO THE PLAGUE IN KARAD IN 1897-8.

(See Question No. 21088.)

Chart showing the entries into Karad Town through the Observation Camp and by means of "periodical examination," less those leaving the Town through the Observation Camp. It is not intended as showing the actual entries into the Town, but shows very well the trend of the population. The red line shows the period when there were more departures from than entries into the Town.

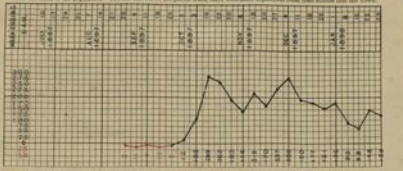


Chart showing progress of Plague in Karad Town, 1897-98. Includes only the attacks and deaths in the Town proper. Attacks red, deaths black.

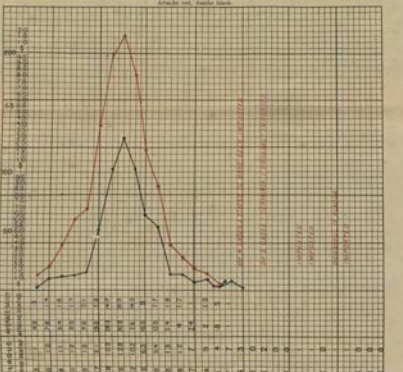


Chart showing the progress of the Plague in Karad Town, 1897-98. Includes all attacks and deaths occurring in Karad Municipal area. Attacks red, deaths black.

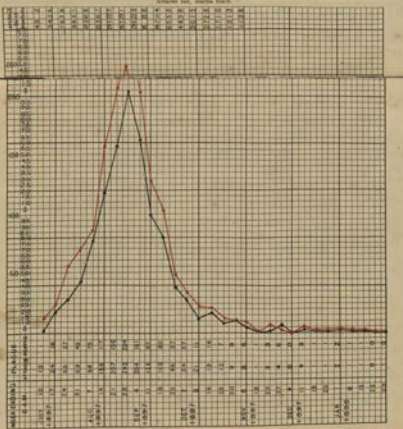
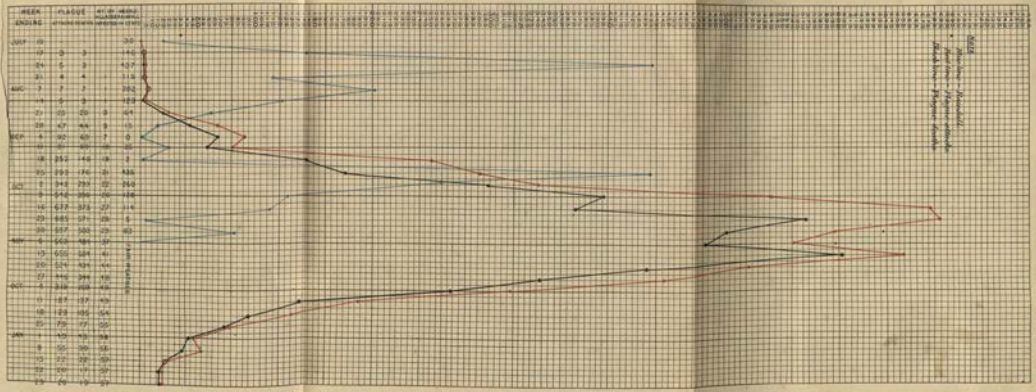


CHART OF THE PLAGUE EPIDEMIC IN THE KARAD VILLAGES DURING THE RAINS OF 1897.


WEEK ENDING
PLAGUE
DEATHS
POPULATION
CASES
Sept. 18
25
Oct. 2
9
16
23
30
Nov. 6
13
20
27
Dec. 4
11
18
25
Jan.
8
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Feb. 5
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Mar. 5
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Apr. 2
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May 7
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21
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June 4
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18
25
July 2
9
16
23
30
Aug. 6
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Sept. 3
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June 6
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July 3
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Sept. 4
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Jan. 1

CHARTS OF THE PLAGUE EPIDEMIC IN 4 TOWNS IN THE KHANDESH DISTRICT, BOMBAY PRESIDENCY.

JALGAON

Pop. 15,000

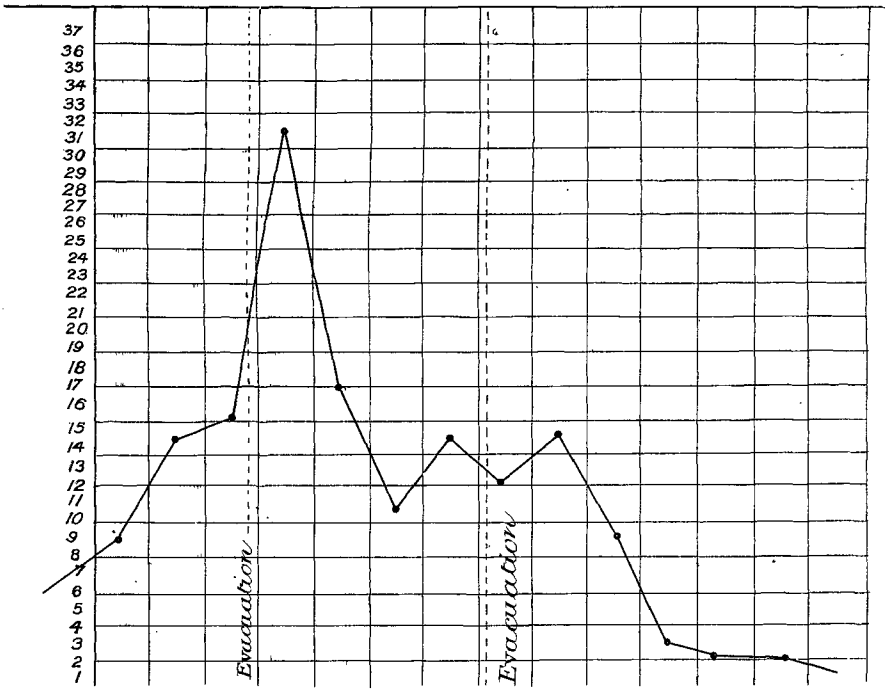
CHART OF PLAGUE ATTACKS

WEEK ENDING (N.B. 8 DAYS TO A WEEK!)

Total attacks — Unrecorded 40 + Recorded 115 = 155

A

1897-8. 22 NOV, 30 NOV, 7 DEC, 15 DEC, 23 DEC, 31 DEC, 7 JAN, 13 JAN, 22 JAN, 31 JAN, 7 FEB, 15 FEB, 23 FEB, 28 FEB,



N.B. 5/6 Town was evacuated between 7 & 15 Dec, 1897.

1/6 " " " " 13 & 22 Jan, 1898.

Y.3905. Ev.110

BHOLANA

Pop. 800

Total attacks 30

CHART OF PLAGUE ATTACKS

WEEK ENDING.

1898. 28 JAN, 4 FEB, 11 FEB, 18 FEB, 25 FEB, 4 MAR, 11 MAR, 18 MAR, 25 MAR,

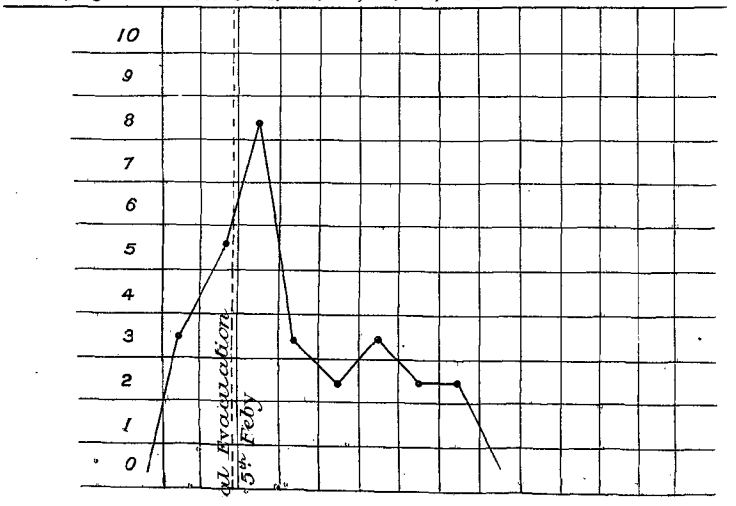


CHART OF PLAGUE ATTACKS

KANASWADI
Pop, 269
Total attacks 25

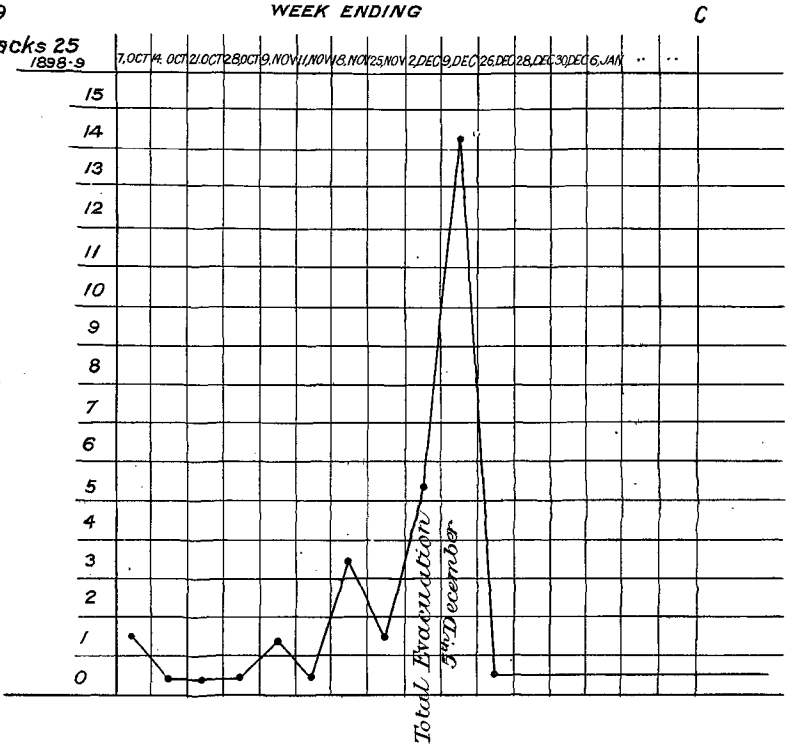
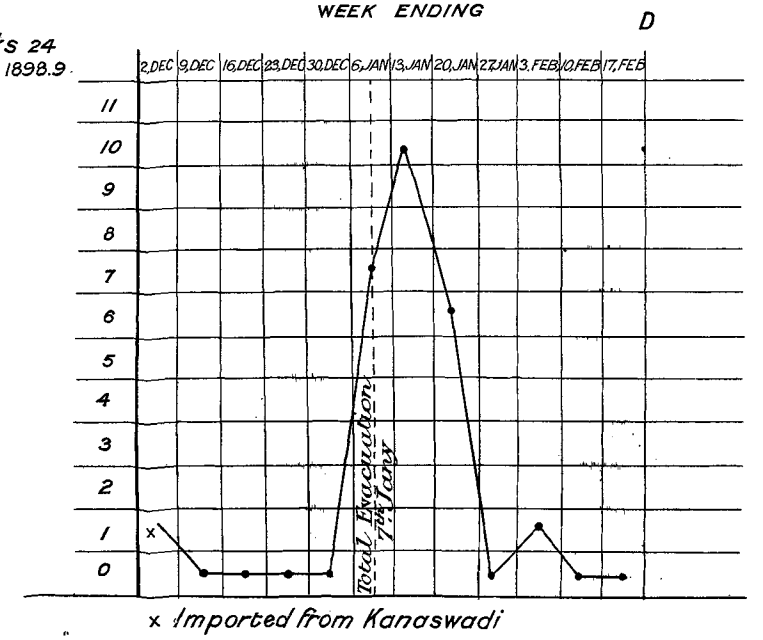


CHART OF PLAGUE ATTACKS

GOZORA
Pop, 950
Total attacks 24



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APPENDIX No. LXVIII.

REPORT by the PLAGUE COMMISSIONER, HYDERABAD, to the GOVERNMENT OF INDIA.

regarding the

DISSEMINATION of the INFECTION of PLAGUE through the Medium of RAW COTTON.

PLAGUE—HYDERABAD STATE.

No. 999 M., dated Camp Mandalgira, the 12th January 1899.

From A. H. STEVENS, Esq., Deputy Plague Commissioner, to Lieutenant-Colonel E. LAWRIE, M.B., I.M.S., Plague Commissioner, Hyderabad State.

I HAVE the honour to report that, from personal observation in plague infected and adjacent areas, I have come to the conclusion that the infection of plague is disseminated through the medium of raw cotton.

My reasons for arriving at this conclusion are as follows:—

I have reported the difficulties that have from time to time been experienced in evacuating houses, and subsequently in disinfecting them (by digging up and burning the floor surfaces by the kiln process) owing to the verandahs and outer rooms (which are almost invariably the sleeping places in village houses) being blocked up with bales of unpressed cotton (the usual size of each bale, which is sewn up in rough gunny cloth, is about 6 × 3 × 3). I have noticed these bales of cotton in almost all the Kopbal infected villages as well as, in a few instances, in Lingsugur, and in the infected villages round Sholapur. I also remember my assistant Mr. Venkatesha Rao reporting the same state of affairs last year at the infected village of Pallaskheda near the Khandesh frontier.

The danger of plague infection being propagated through the medium of cotton bales was most forcibly impressed upon my mind a few days ago, when I saw some hundreds of bales of cotton despatched by rail from Bannikop Station on the Southern Mahratta Railway. On inquiry, I found that this cotton had been brought the same evening from the infected village of Bannikop, which is only one mile from the railway station, and in which over 400 people have within the past two months died of plague. I forthwith rode to the village, which is being disinfected, and saw the last lot of bales of cotton belonging to the consignment taken out of the verandahs of two houses in which I had some weeks before seen plague corpses lying, as well as the sick suffering from plague. The bales were loaded on carts, taken to the railway station, and lifted direct from the carts into closed cotton vans, the interval that elapsed between the bales leaving the infected premises and being packed in the closed cotton waggon was considerably under one hour. The time was 4.30 p.m., when there was little or no sun to destroy the bacillus or infection during transit; and I see no reason why each bale of cotton thus sent should not be a medium for spreading the disease into whatever city or town it is imported; whether taken to a cotton press for pressing, or to a mill for manufacturing, all the conditions surrounding it, and its future treatment, would be favourable to the propagation of plague by means of the infection contained in the bale.

At present, as far as I understand, very little is known as to the actual manner in which plague infection is propagated, but I believe I have hit upon one way in which it may be, by means of the railway, disseminated far and wide into the very centres of cities and towns supposed to be safeguarded and hedged round by the strictest quarantine and other plague regulations.

It is noteworthy how persistently plague has stuck to the cotton manufacturing towns and the cotton producing districts, and no explanation of the reason of this has, I believe, been brought forward.

Possibly cotton itself may, under certain conditions, be a medium favourable for preserving the plague bacillus alive for a long time, and this may explain some of the hitherto unaccounted for outbreaks of plague at various places, the origin of which have never been traced out.

The subject is one that is, I think, worthy of scientific investigation, such as I am unable to bring to bear upon it, and is one that may be advisable for the Plague Commission to inquire into.

With reference to the case in point—the Bannikop cotton—you may ask why I permitted it to be exported? I am not aware that I have any legal power to stop it. The consignments of country produce from these districts are made in fulfilment of contracts with large mercantile firms such as Ralli Brothers and others, and any interference on my part might lead to a law suit. I shall, therefore, be much obliged if my legal powers in the direction of interfering with the cotton and other trades may be exactly defined for my future guidance.

No. 472, dated Hyderabad, the 25th January 1899.

From Lieutenant-Colonel E. LAWRIE, Plague Commissioner, Hyderabad, to the FIRST ASSISTANT RESIDENT, Hyderabad.

I HAVE the honour to enclose a copy of a letter from Mr. A. H. Stevens, Deputy Plague Commissioner, Hyderabad State, on the subject of the dissemination of the infection of plague through the medium of raw cotton.

On receipt of Mr. Stevens' letter, I telegraphed to him to forward specimens of the cotton he suspected to contain the infection to me for bacterioscopic examination: and specimens were accordingly received from him on the 22nd instant.

Cultures in sterilised broth were made from these specimens by Dr. Mullanah the same day. On the 23rd instant, the broth had become cloudy and contained a growth. Preparations from this growth showed a variety of organisms, among which a polar-stained bacillus, morphologically resembling the bacillus of plague, was prominent. At 2 o'clock p.m., that day three rabbits, which had been inoculated with a culture of the organisms found in Haffkine's fluid on the 28th of December 1898, and the 1st and 4th of January 1899, were inoculated with ½, 1, and 2 c.c. respectively of the broth culture made from the organisms in the suspected cotton. The temperature of the first rabbit rose rapidly to 105, and it died on the morning of the 25th instant, about 36 hours after the inoculation. *Post mortem* examination showed that it died of plague, and the plague bacillus was found in the glands, in the lungs, and in the spleen. A few were also found in the blood. A control experiment made with ordinary raw cotton bought in the bazar shows that it contains no organisms such as were found in the infected cotton.

The importance of Mr. Stevens' discovery—that the infection of plague can be disseminated through the medium of raw cotton—cannot be over-estimated, and I am of opinion that it ought to be communicated at once to the Government of India and to the Indian Plague Commission.

No. 11-C., dated Hyderabad Residency, the 27th January 1899.

From Sir TREVOR CHICHELE-PLOWDEN, K.C.S.I., Resident at Hyderabad, to the SECRETARY TO THE GOVERNMENT OF INDIA, Home Department.

I HAVE the honour to forward, for the information of the Government of India, a copy of a letter, No. 472, dated the 25th January 1899, from the Plague Commissioner, Hyderabad, with a copy of its enclosure, regarding the dissemination of the infection of plague through the medium of raw cotton.

No. 485, dated Calcutta, the 6th February, 1899.

From R. NATHAN, Esq., Under-Secretary to the Government of India, to the SECRETARY TO THE INDIAN PLAGUE COMMISSION.

I AM directed to forward, for the information of the Indian Plague Commissioners, a copy of a letter from the Resident at Hyderabad, No. 11-C., dated the 27th January, 1899, regarding the dissemination of the infection of plague through the medium of raw cotton.

APPENDIX No. LXIX.

MEMORANDUM ON EXPERIMENTS TO DETERMINE THE PROPHYLACTIC EFFECT OF HAFFKINE'S FLUID ON RABBITS,

Performed by Order of the Plague Commissioner, Hyderabad,

by

Lieut.-Colonel E. LAWRIE, M.B., I.M.S., and Mr. MULLANNAH, M.B.

SUMMARY.

Class A.

Animals protected with re-sterilised Haffkine's fluid.

Recovered after inoculation with plague	9
Died	1
Died from the protective	0
Total	10

Of the animals experimented on in Class A., two had one large dose of the protective (20 c.c.), one had two large doses (20 c.c. each), four had one small dose (2 c.c.), and two had two medium doses (6¼ c.c.). The rabbit that died had two small doses of the prophylactic of 1 c.c each.

Class B.

Animals protected with contaminated Haffkine's fluid.

Recovered after inoculation with plague	20
Died	10
Died from the protective	8
Total	38

Of the animals experimented on in Class B., two of those that recovered had one large dose of the protective (20 c.c.), one had one small dose (2 c.c.), 15 had two large doses (20 c.c.), and two had two small doses (6¼ c.c.). Of those that died in this class, four had one small dose (1 to 6 c.c.), and six had two large doses (20 c.c.) of the protective. One animal that died of the effects of the protective alone died of plague.

It must be noted that for the purposes of the experiments the doses of both the prophylactic, and of the plague cultures, administered by inoculation were unusually large. This was especially the case with the inoculations with the contaminated fluid.

App. LXIX.

TABLE.

No. of Rabbits.	Haffkine's Fluid.						Plague.												Remarks.
	Number of Brew.	Contaminated.	Resterilised.	First Inoculation.		Second Inoculation.		First Inoculation.		Second Inoculation.		Third Inoculation.		Fourth Inoculation.		Fifth Inoculation.		Sixth Inoculation.	
				Date.	Dose.	Date.	Dose.	Date.	Dose.	Date.	Dose.	Date.	Dose.	Date.	Dose.	Date.	Dose.	Date.	Dose.	
2	1713	Contaminated	—	7.8.98	1 c.c.	—	—	10.8.98	3 c.c.	—	—	—	—	—	—	—	—	—	—	Died of plague.
3	1713	"	—	7.8.98	3 c.c.	—	—	10.8.98	3 c.c.	—	—	—	—	—	—	—	—	—	—	"
4	1713	"	—	7.8.98	6 c.c.	—	—	10.8.98	3 c.c.	—	—	—	—	—	—	—	—	—	—	"
6	3250	"	—	16.8.98	6 c.c.	22.8.98	10 c.c.	27.8.98	1 c.c.	11.9.98	1 c.c.	14.9.98	1 c.c.	29.9.98	3 c.c.	8.11.98	1 c.c.	—	—	Alive.
7	3250	"	—	16.8.98	9 c.c.	22.8.98	15 c.c.	27.8.98	1 c.c.	11.9.98	1 c.c.	14.9.98	1 c.c.	29.9.98	3 c.c.	8.11.98	1 c.c.	—	—	"
8	3250	"	—	16.8.98	12 c.c.	22.8.98	20 c.c.	27.8.98	1 c.c.	11.9.98	1 c.c.	14.9.98	1 c.c.	29.9.98	3 c.c.	8.11.98	1 c.c.	—	—	"
10	1713	"	—	19.8.98	9 c.c.	22.8.98	15 c.c.	27.8.98	1 c.c.	11.9.98	1 c.c.	14.9.98	1 c.c.	29.9.98	3 c.c.	8.11.98	1 c.c.	—	—	"
11	1713	"	—	19.8.98	12 c.c.	22.8.98	20 c.c.	27.8.98	1 c.c.	11.9.98	1 c.c.	14.9.98	1 c.c.	—	—	—	—	—	—	Died of plague.
43	3250 (1) / 3962 (2)	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	"
44	3250 / 3962	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	Alive.
45	3250 / 3962	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	"
46	3250 / 3962	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	—	—	—	—	—	—	—	—	—	—	—	—	Died of peritonitis.
47	3250 / 3962	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	Alive.
48	3250 / 3962	"	—	7.10.98	20 c.c.	21.10.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	"
52	4096	"	—	25.10.98	20 c.c.	2.11.98	20 c.c.	7.11.98	1 c.c.	—	—	—	—	—	—	—	—	—	—	"
71	4168 (a)	"	—	19.11.98	20 c.c.	—	—	21.1.99	1 c.c.	—	—	—	—	—	—	—	—	—	—	"
72	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	One loopful.	12.12.98	1 c.c.	—	—	—	—	—	—	—	—	Died of enteritis.
73	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	"	—	—	—	—	—	—	—	—	—	—	Died of tetanus.
74	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	"	12.12.98	1 c.c.	—	—	—	—	—	—	—	—	Alive.
75	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	—	—	—	—	—	—	—	—	—	—	—	—	Died of toxæmia.
76	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	One loopful.	12.12.98	1 c.c.	—	—	—	—	—	—	—	—	Alive.
77	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	"	12.12.98	1 c.c.	—	—	—	—	—	—	—	—	"
78	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	—	—	—	—	—	—	—	—	—	—	—	—	Died of toxæmia. No organisms found, and no growth occurred in media.
79	4168 (a)	"	—	19.11.98	20 c.c.	1.12.98	20 c.c.	6.12.98	One loopful.	12.12.98	1 c.c.	—	—	—	—	—	—	—	—	Alive.
96	4168 (a)	"	—	14.12.98	20 c.c.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died of plague.
97	4168 (a)	"	—	14.12.98	20 c.c.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died of enteritis.

| | | |

REMARKS.

1. Haffkine's fluid is presumably a culture in peptone of the plague bacillus; the bacillus having been killed off the products remain.

2. The fluid is of uncertain strength. As received by us originally it was, without exception, contaminated with organisms of putrefaction. Latterly it has been much purer. It did not occur to us that a fluid sent out from a bacteriological laboratory for inoculation could be contaminated from inefficient or careless preparation or putting up, and we naturally supposed that the organisms we found in the fluid constituted part of its normal composition (one of us, Dr. Mullanah, dissents). The presence of the organisms in the fluid being adventitious or accidental they have no bearing on the question of the value of Haffkine's inoculation against plague, though it is of the last importance to insist on the necessity of preventing contamination of any kind from occurring in the fluid. It is probable that the opposition to vaccination in England is due to accidental contamination of the lymph ordinarily employed having given rise to occasional cases of septic intoxication which have been ascribed, by the ignorant public, to the vaccine lymph itself instead of to its impurities. In this way vaccination has been brought into such discredit that the Vaccination Acts of Great Britain have been practically repealed. There is very little doubt that in a similar manner injury has been done to the cause of Haffkine's inoculation against plague in India.

3. The effects of the contaminated fluid are two-fold. It produced:—

(*a*) Septic intoxication.

(*b*) The so called "reactionary" fever.

4. When employed by inoculation in rabbits—animals which are peculiarly resistant to ordinary septic processes, but are the best of all for experimental purposes with plague—it was found that large doses of the contaminated fluid protected against the effects of subsequent inoculation with plague. Small doses afforded little or no protection. But it was also found that eight animals died of the effects of the protective inoculation alone, while the protection against the effects of subsequent inoculation with plague was so limited that 33·4 °/₀ of the animals experimented upon died of plague.

5. The effects of the Haffkine fluid when resterilised are very different from the above. When employed experimentally in rabbits it was found that large doses are not always required. Moderate or even small doses afford adequate protection. No animals died of the protective inoculation alone, and the maximum of protection is afforded by the fluid against the effect of subsequent inoculation with plague.

6. The effects of inoculation of the sterilised fluid in rabbits, and also, as far as our limited experience goes, in man, are simple. It produces "reactionary" fever alone without, as a rule, any evil consequences. The question is, what is this "reactionary" fever due to? There can be little doubt that it is due to plague. (One of us, Mullannah, says it is due to the plague toxins.) Plague is a disease which shows itself in many forms. In its virulent forms it is highly infectious, in its mild aspects it is hardly infectious at all. To make inoculation universally acceptable what is now wanted is that Haffkine's fluid shall be made of uniform strength, so that with a minimum dose the reactionary fever shall be of known intensity and protective power, and not under any circumstances contagious.

APPENDIX No. LXX.

REPORT

ON A

BACTERIOLOGICAL INVESTIGATION in the PURITY or otherwise of M. HAFFKINE'S PLAGUE PREVENTION INOCULATION FLUID,

BY

CAPT. C. A. JOHNSTON, I.M.S.

From Captain C. A. JOHNSTON, M.B., D.P.H., I.M.S., Medical Officer, 3rd Madras Lancers, to the PRESIDENT, Indian Plague Commission.

SIR, Secunderabad, 9th January 1899.

I HAVE the honour to forward herewith as requested by the Indian Plague Commission, a report on a bacteriological investigation into the purity, or otherwise, of Haffkine's plague prevention inoculation fluid, accompanied with stained preparations of some of the organisms found.

The report has had to be drawn up rather prematurely this day, as I have to accompany my regiment out of Secunderabad on "Long reconnaissance," and shall be absent from the station for a week. I therefore regret that it cannot be so fully drawn up as it otherwise might have been.

BACTERIOLOGICAL EXAMINATION OF HAFFKINE'S FLUID.

Seven bottles of Haffkine's fluid, with the following numbers, taken at random from about 50 others, were examined:—

Brew No. 4168 (A) received at Hyderabad on 19th November 1898.
Brew No. 5324 received at Hyderabad on 16th December 1898.
Brew No. 5338 received at Hyderabad on 16th December 1898.
Brew No. 3962 received at Hyderabad on 20th October 1898.
Brew No. 4096 received at Hyderabad on 20th October 1898.
Brew No. 5349 received at Hyderabad on 16th December 1898.
Brew No. 5315 received at Hyderabad on 16th December 1898.

General Plan of Investigation.

Seven tubes of slant agar were inoculated with the above seven fluids, by allowing 10 to 15 minims of the fluid to flow in each case over the surface of the agar. The necks of the bottles and their mouths and corks were sterilized, and the corks were extracted with sterilized forceps, so as to allow no air or organisms to contaminate their contents and nullify the investigations. Two control tubes of the same preparation of agar were kept, into which tubes no Haffkine's fluid was poured, but whose cotton wool plugs were removed for a few seconds, to imitate the process of pouring fluid in, and then re-applied.

All these nine tubes were kept at the ordinary temperature of the room in a special glass case, and allowed to remain for one day, when they were examined, and it was found that there were growths of living organisms in every one of them except the controls:—Nos. 4168 (A), 5324, 3962, and 4096 showed luxuriant growths, the other three less, and No. 5315 showed least growth of all.

DETAILS OF THE EXPERIMENTS.

No. 1 Haffkine's Fluid: Brew No. 3962.

Ten to 15 minims poured over agar slant gave, after 24 hours, yellow white and ivory white discrete colonies all growing on the surface of the agar. There was no cloudiness, gas formation, or liquefaction. Microscopic examination revealed staphylococci in the white colonies, and bacilli and cocci mixed in the yellowish white colonies. The bacilli are short thick rods joined together in places forming chains, some short, others longer, and some are oval like cocci, and do not take the stain uniformly. The bacilli are actively motile and the threads lazily motile—decolorized by Gram. The first subculture in agar was made of the bacillary colonies (yellowish white), giving as a result yellowish white coalesced colonies, and a few isolated white colonies—these latter consisting of staphylococci and the former of a mixture of bacilli and cocci. A second subculture was therefore made giving also a mixture, but the cocci were fewer in number, so an attenuated third subculture was made with broth, and thrown into a petri dish which gave, in 24 hours a few faint bluish white colonies consisting of bacilli only. This was transferred as a fourth subculture on to agar slant tubes, which gave a pure growth of bacilli only—the growth consisting of a dirty white transparent film. Stained and hanging drop preparations of this film showed the following:—bacilli, fat, straight rods with rounded ends uniformly stained, some single, others joined end to end in pairs, freely motile, the single ones have a wriggling movement, the jointed ones an eel-like movement. The jointed ones appear to be the result of fission in older ones. The bacilli are all decolorized by Gram.

A rabbit (No. 126) was inoculated in the thigh with an emulsion in sterilized broth (4 c.c.) of these bacilli, and a fifth subculture in agar was made and kept. The rabbit (No. 126) had a slight fever (maximum 104·2) for two days, and is now well.

No. 2 Haffkine's Fluid: Brew No. 4096.

Fifteen minims of this was thrown over the surface of an agar slant tube and gave, after 24 hours, lemon yellow confluent colonies, white isolated colonies, and white moulds. No cloudiness of agar, nor liquefaction, nor odour were observed.

Microscopical examination revealed staphylococci in the yellow and white colonies—and mucor mucedo in the mould. No bacilli were present.

No. 3 Haffkine's Fluid: Brew No. 4168A.

Ten to 15 minims were poured over the surface of an agar slant tube, and within 24 hours there was a feathery greyish white growth—and after 48 hours a luxuriant growth of greyish white and yellow expansion. On using a magnifier the colonies are small, circular, and discrete, some being whitish and some yellowish white—at the bottom of the tube a distinct clump of ivory white colonies was seen, small, circular, and coalescing. No liquefaction of agar—all growing on surface.

Microscopic Examination.—By cover glass, stained with gentian violet, the microscope showed staphylococci, micrococci, diplococci, and some bacilli. Hanging drop preparation shows Brownian movement and very feeble motility.

1st Subculture.—A little of the culture was mixed with sterilized broth attenuated and spread over a petri dish of agar, and gave as a result, within 24 hours, separate lemon yellow colonies as well as small pearl-like discrete ones, and a clump of greyish white colonies. Cover glass preparations showed staphylococci in the lemon yellow colonies, cocci (mono. and diplo.) in the grey white clumps, and bacilli in the

pearly blue ones. A second subculture of these pearly blue colonies was made into agar slant tubes with the result that luxuriant growth took place in 24 hours, of small pearly blue colonies, which coalesced. Cover slip and hanging drop preparations show a short fat coccoid bacillus, straight, very feebly motile, not of uniform thickness, not staining uniformly, with rounded ends, and no general true polar staining; decolorized by Gram's method, some of the bacilli appear like oval cocci.

A rabbit (No. 109) was inoculated with 3 c.c. of a mixture of these bacilli in sterilized broth into the subcutaneous tissue of the thigh, and as a result had slight fever—maximum temperature 103·6° for two days —no other signs of illness, and is now quite well.

A third subculture of the pearly blue colonies of the first subculture (petri dish) was made into agar slant and left for three days. When examined the same pearly blue coalesced colonies were seen, which on microscopic examination showed fields of cocco-bacilli which do not stain uniformly and are very feebly motile. A rabbit (No. 110) was inoculated in the thigh with 4 c.c. of this subculture mixed with sterilized broth, and had a rise of temperature to 105·2° for a day, then lysis to normal.

No. 4. Haffkine's Fluid: Brew No. 5315.

Ten to 15 minims thrown over agar slant gave within 48 hours a faint growth of isolated clear colonies —which on microscopic examination revealed staphylococci. No bacilli were found. Rabbits (Nos. 122, 123, and 124) were inoculated subcutaneously with this fluid, re-sterilized by fractional method to 65° C. for one hour for three consecutive days and gave with No. 122 a maximum temperature of 104·6° the same evening, and fever the following two days to 104·2°, then fell to normal. Rabbit No. 123 gave 105° same day, next day 106°, then lysis to normal. No. 124 gave 105° same evening and 105° next day, then lysis to normal. A rabbit No. 128 was inoculated with the same quantity of the same fluid unsterilized, and gave 104° the same evening and 104·4° next day.

These Haffkinized rabbits are to be tested as regards their immunity against an inoculation of plague.

No. 5. Haffkine's Fluid: Brew No. 5324.

Ten to 15 minims of this fluid were thrown over the surface of an agar slant tube. Within 24 hours it showed a thick luxuriant growth of greyish white colonies, some the size of a small pin's head; in other parts of the tube a whitish film. All the colonies are growing on the surface of the agar, without liquefaction or odour. Microscopic examination of these colonies by stained cover glass and hanging drop preparations show staphylococci and long bacilli, varying in length, with rounded ends, and straight rods. Some of the rods show swelling in the middle and do not stain uniformly. Hanging drop preparation shows these bulgings very distinctly and the bacilli are feebly motile. The bacilli are decolorized by Gram's method, but the bulging portion retains a little of the stain. They were mainly found in the whitish films of the culture, so the first subculture from this film was made on an agar slant tube which showed a luxuriant growth of whitish expansion as well as a yellow expansion. On microscopical examination these are found to consist of bacilli as well as cocci, so an attenuated second subculture mixed with sterilized broth was thrown on to a petri dish. This showed three distinct forms of growth—a yellow brain-like expansion consisting mainly of staphylococci, a white brain-like expansion consisting mainly of cocci, and isolated grey white colonies consisting mainly of bacilli. A third subculture was therefore made of these isolated grey white colonies on to agar slant tubes. This third subculture shows a pure growth of bacilli which are straight rods, short and fat, somewhat like oval cocci, most of them non-motile, occasionally some of them, joined end to end, show motility.

[N.B.—A subculture of this has been sent to the Plague Commission.]

Rabbit No. 119 was inoculated with 4 c.c. of this third subculture in sterilized broth into the thigh. It gave a rise of temperature to 105° F. for one day and the temperature is 104° F. now.

A subculture was made of the yellow brain-like colonies of staphylococci from the second subculture of the petri dish to obtain a pure growth of the organism, and rabbit No. 121 was inoculated in the ear with 1 c.c. of the growth in sterilized broth, giving as a result pyrexia to 104° F. with local œdema, swelling, and congestion, and later an abscess and ulceration.

No. 6. Haffkine's Fluid: Brew No. 5338.

Ten to 15 minims of the fluid were poured over the surface of an agar slant tube, and after 48 hours a growth appeared as a thin dewy veil, with a few isolated colonies like dewdrops, and a dozen or so of raised round whitish colonies about the size of a small pin's head. No clouding or liquefaction or odour of agar.

Cover glass preparations (hanging drop and stained) were made and showed from the dewy veil and dew-drop colonies mainly cocci, while that from the white colonies showed bacilli.

The bacilli were short rods with rounded ends, in length about half the diameter of a blood corpuscle, some are in chains and a few are smaller like oval cocci—they stain fairly uniformly, but are decolorized by Gram's method. They have a very feeble movement in hanging drop—some are motionless. A first subculture of these whitish colonies was made on agar slant giving a fairly luxuriant growth of a yellowish white expansion which shows a mixture of staphylococci and bacilli. A further attenuation by a second subculture (mixed with sterilized broth) was made on a petri dish. The petri dish gave within 36 hours bluish white colonies containing long chains of bacilli—which were at once transferred by a third subculture on to an agar slant tube—which gave a growth of yellowish white colonies consisting only of bacilli. These bacilli varied in size, some were small and coccoid, others were in length about half the diameter of a blood corpuscle, and many were seen joined end to end (chiefly in pairs) giving short chains—their ends were rounded and they were rod shaped—showing feeble eel-like movements. A fourth subculture of this was made in agar slant and the remainder of the third subculture was mixed with 4 c.c. of sterilized broth and injected into the flank of a healthy rabbit (No. 120) on the 1st of January. Early on the morning of the 3rd January, within three days of inoculation, the rabbit died—the signs previous to death were firstly rise of temperature to 103·4°, then a sudden fall to sub-normal with giddiness and slight tremors; no diarrhœa. A *post mortem* examination was held the same morning with the following results:—

On reflecting the skin from the abdomen the blood in the vessels was seen to be very dark in colour and fluid, with patches of hæmorrhages on the subcutaneous surface of the abdomen and thorax. No enlarged glands were present. *Thoracic organs*—fluid in the pericardium—venous engorgement of the heart—lungs normal in appearance—heart blood dark and fluid. *Abdomen*—petechial hæmorrhages in abdominal wall. Large intestines very dark green in colour—spleen not enlarged but very dark. In the regions of the gall bladder, the liver, and adjacent surface of the stomach (which is distended with food) there is bile staining, the kidneys are highly congested and very dark in colour. Agar slant tubes were inoculated with a drop of the heart's blood, peritoneal fluid, spleen blood, and pulp—one pure agar slant tube being kept as control.

The blood, spleen, liver, and peritoneal fluid of the cadaver were examined microscopically, and bacilli were found in all in abundance, except the peritoneal fluid. The bacilli in all appear to stain uniformly (one or two in a field show polar staining) varying in length, but generally the length of half the diameter of a blood corpuscle, rod shaped, with rounded ends, some smaller and more oval and some joined end to end, giving a fission-like appearance. These bacilli are very similar morphologically to the bacilli in the subculture that was used for inoculation.

A fifth subculture was made from the fourth subculture, and another rabbit was inoculated.

Rabbit (No. 125) was inoculated with 4 c.c. of an emulsion of this subculture in sterilized broth, and had a temperature of 104·4 for one day and then lysis to normal.

The cultures in the agar tubes of the blood, &c., of rabbit No. 120, all show luxuriant bacillian growths except the control which shows none. These bacilli are found to be decolorized by Gram's method. The

growth appears to be of the following character:—greyish colonies, the size of pin's heads, circular, coalescing to form a greyish layer—that from the blood shows other kind of colonies raised small circular pearl-like rising above the greyish layer. The growth from the peritoneal fluid seems the purest. On microscopic examination of these growths, the one from the blood shows bacilli, some long rods, rounded ends, which are motile—others smaller, somewhat oval in form, which are not so motile; all show irregular staining, and are thicker at the ends than in the centre. The growth from the peritoneal fluid gave small rod-shaped bacilli, with rounded ends; and oval bacilli which are very feebly motile and do not stain uniformly. When treated first with alcohol and then stained they show polar staining. The culture from the liver shows two forms of bacilli, one set are polar stained, and the other, a longer rod, do not stain at poles. These bacilli are similar morphologically to some of the bacilli found in the subculture that was inoculated into the rabbit, and their culture growths are almost identical. These growths are to be further tested by inoculation into other rabbits, rats, fowls, and pigeons. A subculture of the culture from the rabbit's blood, when put into sterilized broth, made the broth cloudy and colonies fell to the bottom as a grey mass. Rabbit No. 125 had a rise of temperature to 104·5 the day following inoculation, and it is now falling towards normal.

A rabbit (No. 129) was inoculated with a subculture made from the peritoneal fluid of rabbit No. 120 that died, and gave a rise of temperature next day to 106·4°.

A pigeon was inoculated with a subculture of peritoneal fluid of rabbit No. 120 but only gave a rise of temperature to about one degree.

Two fowls were also inoculated subcutaneously and by injection into the mouth of subculture of peritoneal fluid and spleen of rabbit No. 120, but no pathogenic results followed.

The efficacy of re-sterilizing (by fractional method) and inoculation of this brew of Haffkine's fluid was tried on the following rabbits:—

Rabbit No. 111 was inoculated subcutaneously with 20 c.c. of the unsterilized fluid and showed a temperature of 106° (maximum) the second day, then lysis to normal, fever lasting four days. Rabbit No. 125 inoculated with the same quantity of re-sterilized H. F. 5338, subcutaneously, showed temperature of 104·8 (maximum) for a day.

No. 7. Haffkine's Fluid, No. 5349.

Ten minutes of this fluid thrown over agar slant gave within forty-eight hours isolated greyish white colonies and a whitish scum over the agar—no liquefaction or odour—later a few isolated white colonies appeared.

Microscope revealed only micrococci and staphylococci in the isolated white colonies. No bacilli were found.

Conclusions arrived at as the Result of the Experiments up to Date.

The samples of Haffkine's fluid examined bacteriologically all show contamination with living micro-organisms; in some cases—Nos. 5315, 5349 and 4096—the contamination seems to be with cocci alone, in the others, with a mixture of cocci and bacilli. Although the samples taken show the above contamination, other bottles of the same brew show contamination with other forms of micro-organisms. As far as the investigations have gone it will be seen that the micro-organisms isolated from the fluids are many of them distinctly pathogenic, some more virulently so than others, in one case (No. 5338) the microbe was so pathogenic as to cause death (*vide* rabbit 120). Rabbit No. 121 shows the effect of the contamination with cocci, which was the staphylococcus aureus, producing local disease (abscess and ulceration) and a pyæmia. If the temperature charts of the inoculations with one of the brews and the organisms isolated from that brew be compared, it will be seen that the inoculation with the fluid, as received from Bombay, gives a greater rise of temperature in most cases than the pyrexia produced by the isolated organisms; therefore, if the living organisms were extracted from the fluid before inoculation, a lower temperature ought to be the result of inoculating such a fluid. This idea seems to be confirmed when the temperature charts of rabbits 101 and 105 are compared. No. 101 is the result of inoculation of Haffkine's fluid No. 4168, giving a rise of temperature to 106°, followed by death; whereas No. 105 shows the result of inoculation of the same of Haffkine's fluid re-sterilized giving a resulting temperature of 104·5 as the maximum and, instead of death, recovery. This is one example of the effect of re-sterilizing Haffkine's fluid, but others are now being carried out. It would appear, therefore, that re-sterilizing does away with a severe form of septic fever and complications which arise from the contaminating organisms; but the question whether this re-sterilizing destroys the efficacy of the original Haffkine's fluid remains to be considered, this is also being done—*vide* temperature chart of rabbit No. 105 (Haffkinized with brew No. 4163). One c.c. of plague culture was inoculated on the 1st January, giving a slight fever only, whereas the control rabbit No. 115, inoculated on the same day with the same dose of the same culture, gave a rise of temperature to 107 and death. The re-sterilized Haffkine's fluid was tested as regards the presence of any living organisms at the same time as inoculation was done, but no living organisms were found to grow on the agar tube. Temperature charts of rabbits Nos. 122, 123, 124, 128 and 130 can be compared also, with regard to the question of re-sterilizing, but it ought to be borne in mind that this brew of Haffkine's fluid showed only slight contamination of cocci.

The following deductions may be drawn from the experiments that have been done so far:—

1stly, that in bottling the Haffkine's fluid from the retorts sufficient care does not seem to have been exercised in preventing contamination.

2ndly, allowing that same contamination is unavoidable, due to the enormous out-turn of fluid necessary to meet the demand, all the bottles on being filled and before being sent away should be re-sterilized to 60° C. for an hour, and the corks should be replaced by proper fitting glass stoppers. This probably would not destroy the chemical products of putrefaction. If this were done, and if it was proved that re-sterilizing does not injure the protective influence of the inoculation fluid, then I feel sure there would be less number of cases of septic poisoning among the inoculated subjects, for the fluid which is received now from Bombay is undoubtedly a "putrescent organic liquid," as stated before the Commission by the Plague Commissioner, Hyderabad.

Further investigations and experiments with reference to the inoculation fluids and their isolated living organisms are being carried out by the authorities in charge of the laboratory in Hyderabad in continuation of the above work, and if so required, a further report at a later date can be furnished by them.

My thanks are due to Lieut.-Col. E. Lawrie, I.M.S., for allowing me to use the laboratory; and to his staff for their kind assistance during the above work.

PLAGUE—HYDERABAD STATE.

INVESTIGATIONS TABULATED.

Bacterioscopic Examination of Haffkine's Fluid.

No. 1.

Agar slant.
+
H. F. No. 4168 A.

↓

Luxuriant growth, a mixture of cocci and bacilli.

↓

1st subculture.
Attenuated in broth; and a petri dish inoculated.

↓

3 separate colonies.
A. Lemon yellow=staphylococci.
B. Grey white =cocci { mono—diplo—
C. Pearly blue =bacilli.

C

2nd Subculture agar slant. One day's growth.	3rd Subculture agar slant. Three days' growth.
Bacilli, pure growth of pearly blue circular colonies coalesced. Bacilli, short fat (cocco-bacilli) feebly motile.	Bacilli, pure growth, pearly white coalesced colonies, mainly cocco-bacilli.
Rabbit No. 109 was inoculated with 3 c.c. of this growth mixed with broth. Result, fever slight (103·6° max.) for 3 days—now alive and well.	Rabbit No. 110 inoculated. Result, fever 4 days max. temp. 105·2°, now alive and well.

No. 2.

Agar slant.
+
H. F. No. 5324.

↓

Luxuriant growth of Staphylococci and bacilli.
1st subculture.

↓

Attenuated by subculture in agar slant.

↓

2nd subculture with broth (control of broth, done 3 Jan. 1899.)
Attenuation on to petri dish.

↓

Three kinds of growth.
A. Yellow brain-like growth =cocci.
B. White do. do. =cocci.
C. Isolated grey-white colonies=bacilli.

C. Bacilli.	A. and B. Cocci.
3rd Subculture into agar slant. One day's growth.	Subculture in agar of pure staphylococci.
Luxuriant pure growth of whitish grey film of bacilli. Bacilli=short fat coccus-shaped, spore formation seen, motile at times, but chiefly non-motile.	Rabbit's ear (121) inoculated with above, gave local abscess and ulceration.

(A special subculture of this was sent to the Plague Commission.)

↓

Rabbit No. 119 inoculated with 4 c.c. of this pure subculture:
Result, fever, max. temp. 105°.

No. 3.

Agar slant.
+
H. F. No. 5338.

Growth, mixture of cocci and bacilli.

Subculture in agar slant.

Luxuriant growth of cocci and bacilli.

Attenuated 2nd subculture in petri dish.

Yellow and white colonies of staphylococci.
Blue white colonies of bacilli.
Bacilli=irregular size, some thin, others thick, jointed and oval (motile).

* A subculture (4th) kept, and a rabbit No. 120 inoculated with 4 c.c. of culture in broth.

Death within 60 hours, temp. sub-normal.

Cultures in agar were made of spleen liver and peritoneal fluid of this rabbit, giving growth of bacilli similar to the bacilli in the subculture.

* The subculture shows thickish bacilli motile growing by fission.

No. 4.

Agar slant.
+
H. F. No. 3962.

Luxuriant growth, mixture of cocci and bacilli; cocci=mono, diplo, and staphylococci.

Subculture in agar slant.

A. Yellow coalesced colonies=bacilli and cocci.

B. White isolated colonies =staphylococci

2nd Subculture in agar.

Bacilli chiefly, also a few cocci.

3rd. Attentuated subculture with broth on to petri dish—shows gossamer veil expansion over which a thick yellow white expansion is present.

4th. Subculture on agar slant gives luxuriant growth of yellow white colonies of bacilli similar morphologically to bacilli from 5338.

Subculture on agar slant of liquid yellowish expansion.

Subculture on agar slant.

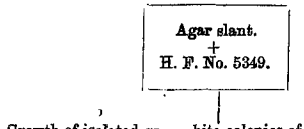
Rabit No. 126 inoculated with 4 c.c. of bacilli subcutaneously, result, slight fever, now well.

No. 5.

Agar slant.
+
H. F. No. 4096.

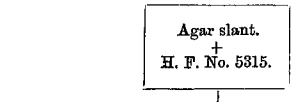
Luxuriant growth of—
Lemon yellow colonies=Staphylococci.
White =Staphylococci.
Moulds whitish =Mucor mucedo.
No bacilli found.

No. 6.



Growth of isolated grey white colonies of micro-cocci only.
One or two white isolated colonies of staphylococci.

No. 7.

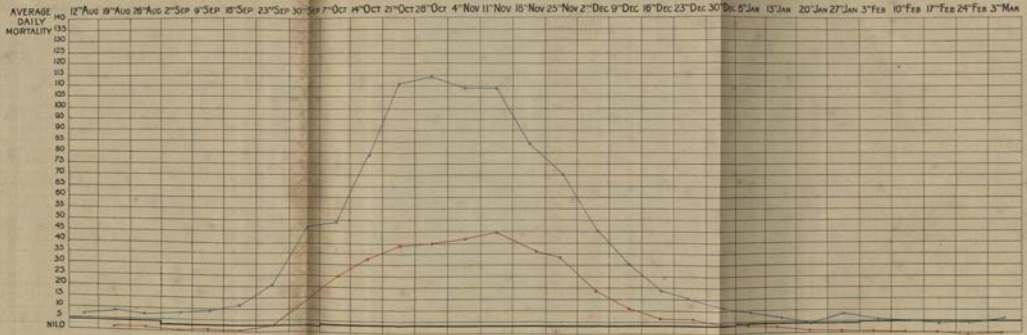


Faint growth of clear hyaline-like colonies of staphylococci.
No bacilli.

APPENDIX No. LXXI (1) (See Question No. [illegible])

PLAGUE CHART BANGALORE CITY.

SHEWING AVERAGE MORTALITY EACH WEEK.



APPENDIX No. LXXI (1)

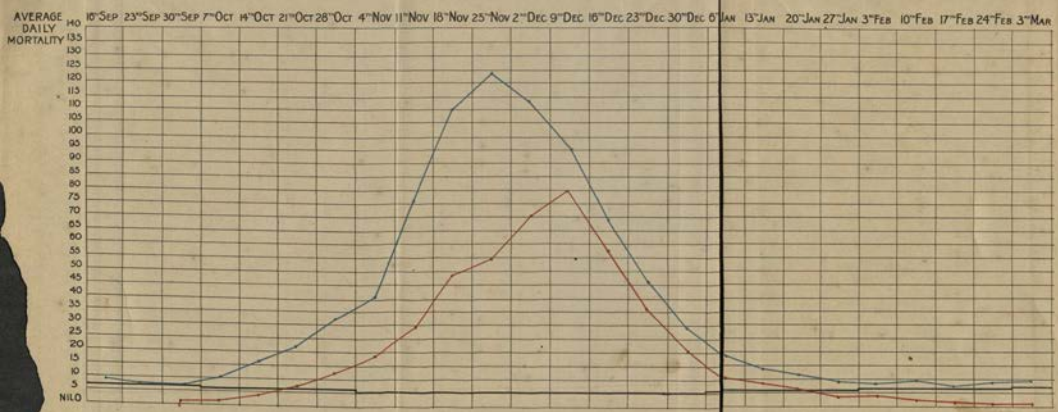
REFERENCE

BLUE LINE SHEWS			TOTAL MORTALITY
RED	Do	Do	DEATHS RECORDED FROM PLAGUE
BLACK	Do	Do	NORMAL WEEKLY DEATH RATE FOR PREVIOUS FIVE YEARS

APPENDIX No. LXXI (ii). (See Question No. 21,085.)

PLAGUE CHART CIVIL AND MILITARY STATION, BANGALORE.

SHEWING AVERAGE MORTALITY EACH WEEK.



Y3905 /87

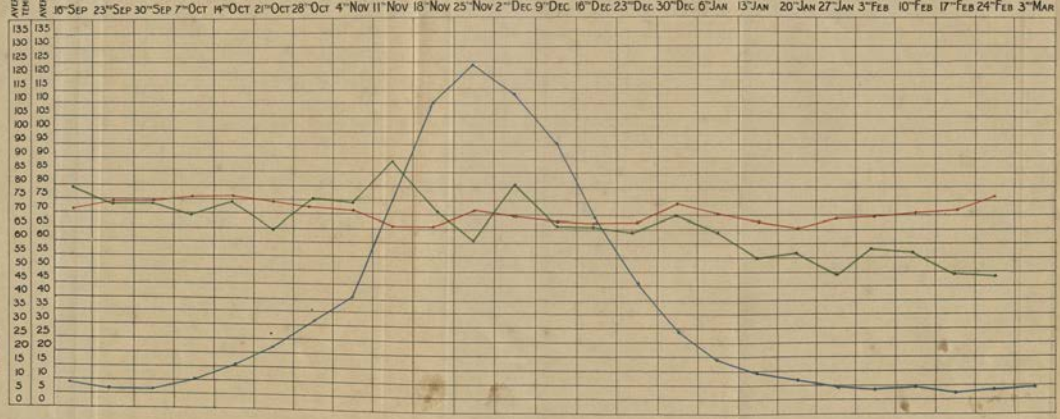
REFERENCE

BLUE LINE SHEWS TOTAL MORTALITY
RED D° D° DEATHS RECORDED FROM PLAGUE
BLACK D° D° NORMAL WEEKLY DEATH RATE FOR PREVIOUS FIVE YEARS

APPENDIX No. LXXI (iii). (See Question No. 25,055.)

PLAGUE CHART CIVIL AND MILITARY STATION, BANGALORE.

SHEWING TEMPERATURE AND HUMIDITY DURING COURSE OF PLAGUE.


AVERAGE DAILY DEGREE OF TEMPERATURE & HUMIDITY
AVERAGE DAILY MORTALITY
10th Sep 23rd Sep 30th Sep 7th Oct 14th Oct 21st Oct 28th Oct 4th Nov 11th Nov 18th Nov 25th Nov 2nd Dec 9th Dec 16th Dec 23rd Dec 30th Dec 6th Jan 13th Jan 20th Jan 27th Jan 3rd Feb 10th Feb 17th Feb 24th Feb 3rd Mar
135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0

Y3905 /90

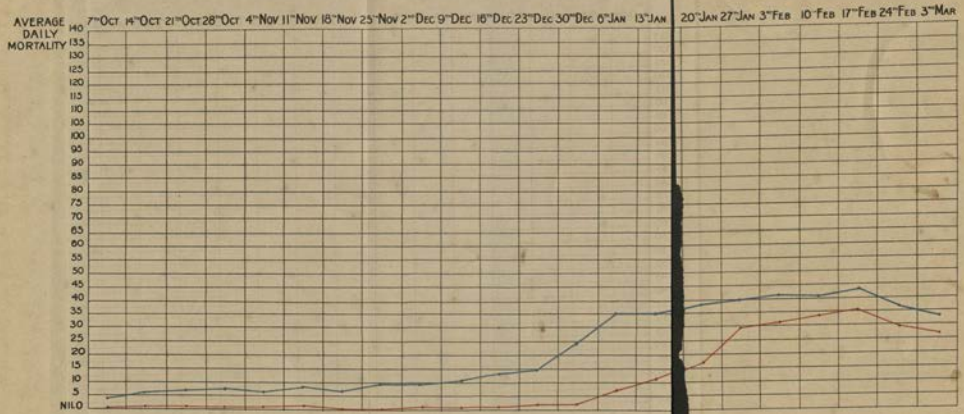
REFERENCE

BLUE LINE AVERAGE MORTALITY BY WEEKS
RED D° D° MEAN TEMPERATURE
GREEN D° D° HUMIDITY

APPENDIX No. LXXI (iv). (See Question No. 20,055.)

PLAGUE CHART MYSORE CITY,

SHEWING AVERAGE MORTALITY EACH WEEK.



Y3905 /

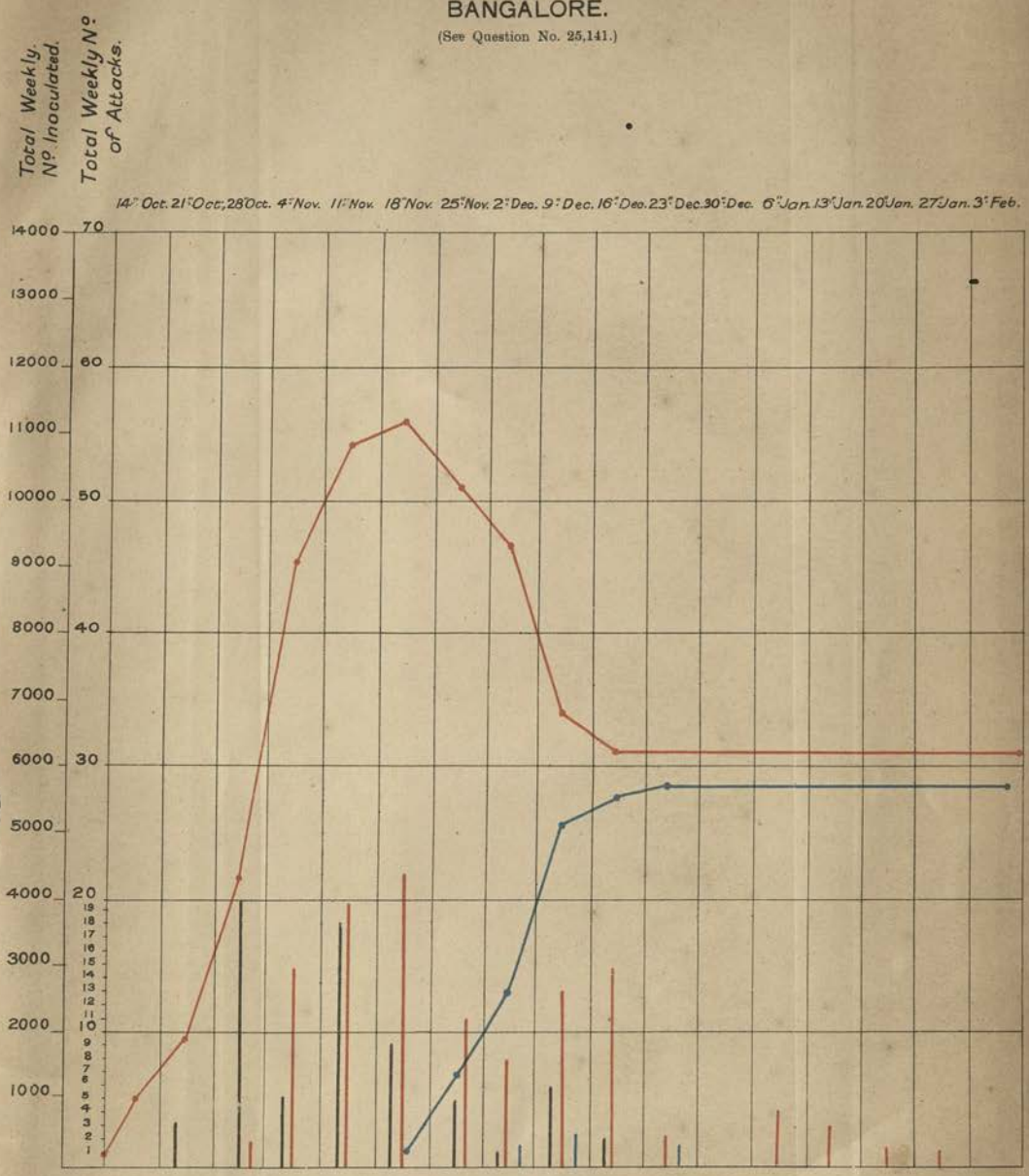
REFERENCE

BLUE LINE SHEWS TOTAL MORTALITY

RED Do Do DEATHS RECORDED FROM PLAGUE

PLAGUE AND INOCULATION AMONG MILITARY POPULATION, BANGALORE.

(See Question No. 25,141.)



REFERENCE

RED CURVED LINE SHEWS TOTAL NUMBER ONCE INOCULATED WEEK BY WEEK

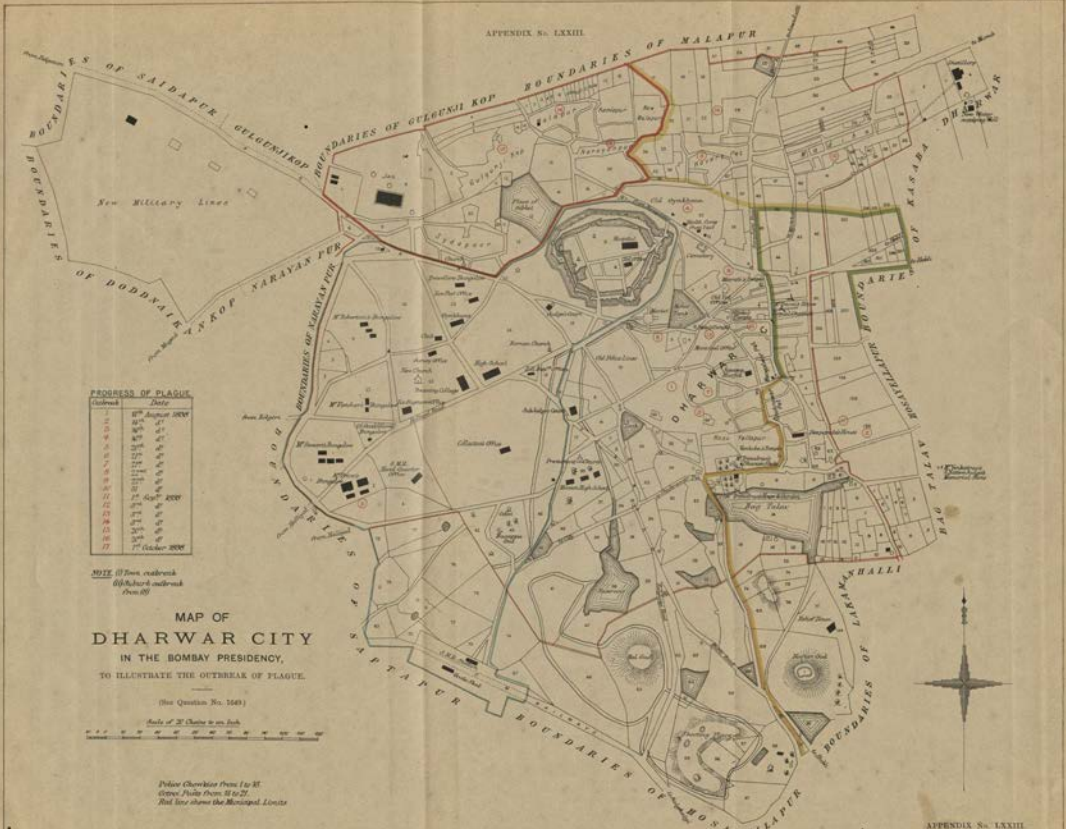
BLUE—Dº——Dº——Dº——Dº——Dº——TWICE——Dº——Dº——Dº—

BLACK VERTL Dº——Dº——SEIZURES AMONG UNINOCULATED

RED——Dº——Dº——Dº——Dº——Dº——ONCE INOCULATED.

BLUE——Dº——Dº——Dº——Dº——Dº——TWICE——Dº——

Y3905.


BOUNDARIES OF SAIDAPUR
GULGUNJIKOP
BOUNDARIES OF GULGUNJI KOP
BOUNDARIES OF MALAPUR
New Military Lines
BOUNDARIES OF DODDAIAHANKOP
NARAYAN PUR
BOUNDARIES OF KARIYAPUR
BOUNDARIES OF KASABA
DHARWAR
BOUNDARIES OF MOTALAPUR
DHARWAR
BOUNDARIES OF SAPTAPUR
BOUNDARIES OF LAKAMANHALLI
BOUNDARIES OF HOSAYELLAPUR
PROGRESS OF PLAGUE.
Outbreak
Date
1st September 1896
1st October 1896
NOTE (1) Town outbreak
(2) School outbreak
From (1)
MAP OF
DHARWAR CITY
IN THE BOMBAY PRESIDENCY,
TO ILLUSTRATE THE OUTBREAK OF PLAGUE.
(See Question No. 1649.)
Scale of 2 Chains to an Inch.
Police Chowkies Press 1 to 10.
Cotton Prints From 11 to 27.
Red line shows the Municipal Limits

APPENDIX No. LXXIV.

MAP OF HUBLI

IN THE DHARWAR DISTRICT OF BOMBAY,

TO ILLUSTRATE
THE OUTBREAK OF PLAGUE.

(See Question No. 1649.)

No.	Date.
1	4-11-97
2	7-11-97
3	8-12-97
4	13-12-97
5	14-12-97
6	20-12-97
7	31-12-97
8	9- 1-98
9	10- 1-98
10	18- 1-98
11	30- 1-98
12	1- 2-98
13	3- 2-98
14	7- 2-98
15	4- 3-98
16	5- 3-98
17	Do.
18	7- 3-98
19	8- 3-98
20	12- 3-98
21	22- 3-98
22	11- 4-98
23	13- 4-98
24	14- 4-98
25	Do.
26	18- 4-98
27	Do.
28	21- 4-98
29	26- 4-98
30	29- 4-98
31	2- 5-98
32	6- 5-98
33	10- 5-98
34	14- 5-98
35	Do.
36	15- 5-98
37	17- 5-98
38	18- 5-98
39	Do.
40	Do.
41	23- 5-98
42	24- 5-98
43	26- 5-98
44	27- 5-98
45	Do.
46	Do.
47	Do.
48	29- 5-98
49	Do.
50	Do.

APPENDIX No. LXXV

STATISTICS regarding VESSELS which left BOMBAY from 1st December 1898 to 15th March 1899.

(In continuation of the figures published in App. No. X. in Vol. I.)

1898-99.	Vessels left for Aden, Red Sea, and Europe.					Vessels left for Ports out of India, other than Aden, Red Sea, and Europe.					Vessels left for Indian Ports, including Burma.				
	No. of Vessels.	No. of Crew.	No. of Passengers.	Tota No. of Crew and Passengers.	No. rejected.	No. of Vessels.	No. of Crew.	No. of Passengers.	Total No. of Crew and Passengers.	No. rejected.	No. of Vessels.	No. of Crew.	No. of Passengers.	Total No. of Crew and Passengers.	No. rejected.
Dec. 1898 - -	21	2,350	2,185	4,535	59	57	2,550	1,204	3,754	49	6,308	48,766	56,352	105,118	1,327
Jan. 1899 - -	31	2,807	4,645	7,452	36	81	2,998	1,271	4,239	35	6,484	47,696	53,698	106,594	1,724
Feb. „ - -	29	4,550	2,209	6,759	48	71	2,419	835	3,254	44	6,510	46,613	64,287	110,900	3,135
Mar. 1 to 15, 1899	16	1,616	2,884	5,500	23	24	1,013	512	1,525	60	3,648	26,524	38,732	65,256	1,673
Totals for 1897 -	233	27,388	29,060	56,448	181	375	18,350	14,512	32,862	206	39,957	316,322	305,082	621,404	2,935
„ „ 1898 -	381	30,991	26,997	57,988	552	402	20,742	12,963	33,705	547	52,609	430,249	399,886	830,135	3,813
1 Jan. to 15 Mar. 1899.	76	8,973	9,738	18,711	107	176	6,409	2,618	9,018	139	16,642	121,033	161,717	212,750	6,532
Grand Total	690	67,352	65,795	133,147	840	953	45,492	30,093	75,585	892	109,208	867,604	836,685	1,734,2	23,279

Total number of vessels examined - - - - 110,851
„ „ „ crew „ - - - - 980,448
„ „ „ passengers „ - - - - 962,573
„ „ „ persons rejected - - - - 25,011

APPENDIX No. LXXVI.

NOTES ON THE TRAFFIC

between BOMBAY and MADAGASCAR

with special Reference

to the OUTBREAK of PLAGUE in TAMATAVE.

I. The Island of Madagascar, situate off the East Coast of Africa, forms the Eastern boundary of the Mozambique Channel. At the northern extremity of the Island is situate Dioga Saurez, the nearest port to Bombay, and much further down its eastern coast, the Port of Tamatave. On the northern half of the western face of the Island are situated Majunga and Nossi Bé: and between these latter and the Mozambique and Zanzibar portion of the opposing African shore the Islands of Mayotta and Comoro which, like Madagascar, belong to the French. All these places have at one time or other been called at by vessels leaving Bombay, and will be referred to again in what follows.

II. It is important to note that the minimum duration of the voyage from Bombay to the nearest port in Madagascar, viz., Dioga Saurez, for the class of steamers that run in that direction, is 15 or 16 days, and, for country craft, under the most favourable conditions of wind and weather, a month.

III. The outbreak of plague at Tamatave, and the subsequent statement of Dr. Proust that it had been proved that the disease had been carried to the Island, not by native craft, but by a ship laden with rice from Bombay, led to a careful investigation, having for its object the drawing up of a precise statement of the nature and amount of traffic, if any, between this port and Madagascar. The lines on which this investigation were carried out were as follows:—

Carefully kept registers of all ships *leaving* Bombay were scrutinised, and those leaving, not only for Madagascar, but for all Islands in the Indian Ocean lying west of India, and for all ports on the African coast were carefully tabulated. Such of the official logs of these ships as were available were then carefully examined, and the owners or agents of all ships in the list were interviewed.

IV. The information obtained was as follows:—

(1.) STEAMERS.

(*a.*) The British India Steam Navigation Company have not despatched any vessel, directly or indirectly, to any port in Madagascar probably for the last 10 and certainly for the last six years; nor have they booked cargo or passengers for trans-shipment to vessels bound for any port in the French Colony. They frequently send cargo to Zanzibar, and it may be that Zanzibar merchants may, and probably do, send portions of it on to Malagise ports, but the connection is a very indirect one indeed, the cargo having first to be landed and lie for some time in stores before being reshipped.

(*b.*) The German East Africa Company's steamers ply between Bombay and the East Coast of Africa, others of their vessels run up and down the African coast. The former never by any chance call at Bourbon, Mauritius, or Madagascar. The latter do call at Malagise ports. The Company have never sent either passengers or cargo from Bombay for trans-shipment on to their African steamers for Madagascar.

(*c.*) The Persian Steam Navigation Company have had no ships running to Madagascar since the end of 1897. Prior to this date (end of 1897) they did despatch an occasional vessel with cargo and passengers from Bombay and had intended to keep up a regular traffic with the Island, but a heavy tax on British borne goods, especially rice, and a heavy annual poll-tax on British subjects, natives of India, for the privilege of living in the Colony imposed by the French Government, had completely choked off the trade. The last of their vessels that had called at Madagascar was the s.s. *Mohammadi*. She left Bombay on the 9th of August 1897 with 691 passengers and a cargo composed largely of rice; ran direct to Delagoa Bay, where she discharged the greater number of her passengers and a portion of her cargo, and then proceeded to Madagascar, where she discharged the remainder of her passengers (not more than 50 in all (chief officer's statement)) and the following quantities of rice:—

Majunga	-	-	about 600 bags.
Nossi Bé	-	-	,, 800 ,,
Dioga Saurez	-	-	,, 2,900 ,,
Tamatave	-	-	,, 300 ,,

On this voyage the official log-book shows but one case of sickness, that of a native cook who was certified by the ship's surgeon to have died of "paralysis." This death took place between Dioga Saurez and Tamatave, 41 days after leaving Bombay, and after an illness of 30 days.

(*d.*) Mr. Haji Kasim has had steamers running from Calcutta, False Point, Balasore and other ports on the east coast of India to Bourbon, and perhaps Mauritius. These steamers may have been chartered from these places for Madagascar, but he is unable to give the details without reference to his agents on the other side of India. During the whole of 1898 and 1899 up to date, he has not sent any steamers from Bombay or any port on the west coast of India, directly or indirectly, to any port in Madagascar; nor has he, *at any time*, sent passengers or cargo to the Colony. During 1897 some of his Bombay ships did go to Madagascar but all these were chartered from Mauritius, left the Island in ballast and returned with bullocks. These steamers may have on rare occasions carried cargo to Madagascar, but this was Mauritius and not Indian cargo. The cessation of traffic with Madagascar, he stated, was due to the extraordinary high rate of duty charged on goods carried under the British flag.

(2.) COUNTRY CRAFT.

The pre-monsoon country craft traffic for 1898 began with a departure on January 8th and ended with one on the 7th of March. Between these two dates 17 vessels left Bombay for various ports in Madagascar, but none of these were bound for Tamatave. So that if they did ultimately go to that port they must have done so in the coasting trade of the Island. It is important to note here that Dr. Proust states that it has been distinctly proved that the plague was not carried to Madagascar by these vessels.

The post-monsoon traffic of 1898 opened with a departure on the 12th of December. From this date till the end of the year five vessels took out their port clearances and bills of health for Madagascar. Here again, not only were none of these vessels bound for Tamatave, but, to quote from a letter from the French Consul at Bombay, they would have arrived at their destinations after Tamatave was declared an infected port.

The following are precise details of this traffic:—

PRE-MONSOON.

Dates.	Name of Ship.	Port bound for.
1898.		
Jan. 8	Batel Sawai - - -	Nossi Bé.
„ 8	Bugla Sahula - - -	Mayotta.
„ 15	Gunja Fatch Salamat -	Nossi Bé.
„ 15	„ Ali Madat - - -	Nossi Bé.
„ 15	„ Daria Dowlat - -	Nossi Bé.
„ 24	Batel Jairam Parsad - -	Majunga.
„ 29	Gunja Hedree - - -	Nossi Bé.
„ 31	Batel Daulat Parsad - -	Majunga.
Feb. 1	Gunja Daulat Parsad - -	Comoro.
„ 4	„ Kulter Parsad - -	Mayotta.
„ 4	„ Duruka Parsad - -	Majunga.
„ 4	„ Fatch Halbat - -	Mayotta.
„ 5	„ Sugar Parsad - -	Comoro.
„ 15	„ Fatch Karim - -	Majunga.
Mar. 2	„ Ali Madat - - -	Majunga.
„ 7	„ Fateh Salamat - -	Mayotta.
„ 7	Batel Sanklee - - -	Comoro.

POST-MONSOON.

Dec. 12	Gunja Fateh Salamat - -	Nossi Bé.
„ 16	„ Ali Madat - -	Dioga Saurez.
„ 17	„ Naran Parsad - -	Mayotta.
„ 19	„ Luckmi Parsad - -	Mayotta.
„ 24	Batel Husseinie - - -	Mayotta.

V. The known facts of the case may thereupon be summarised as follows:—

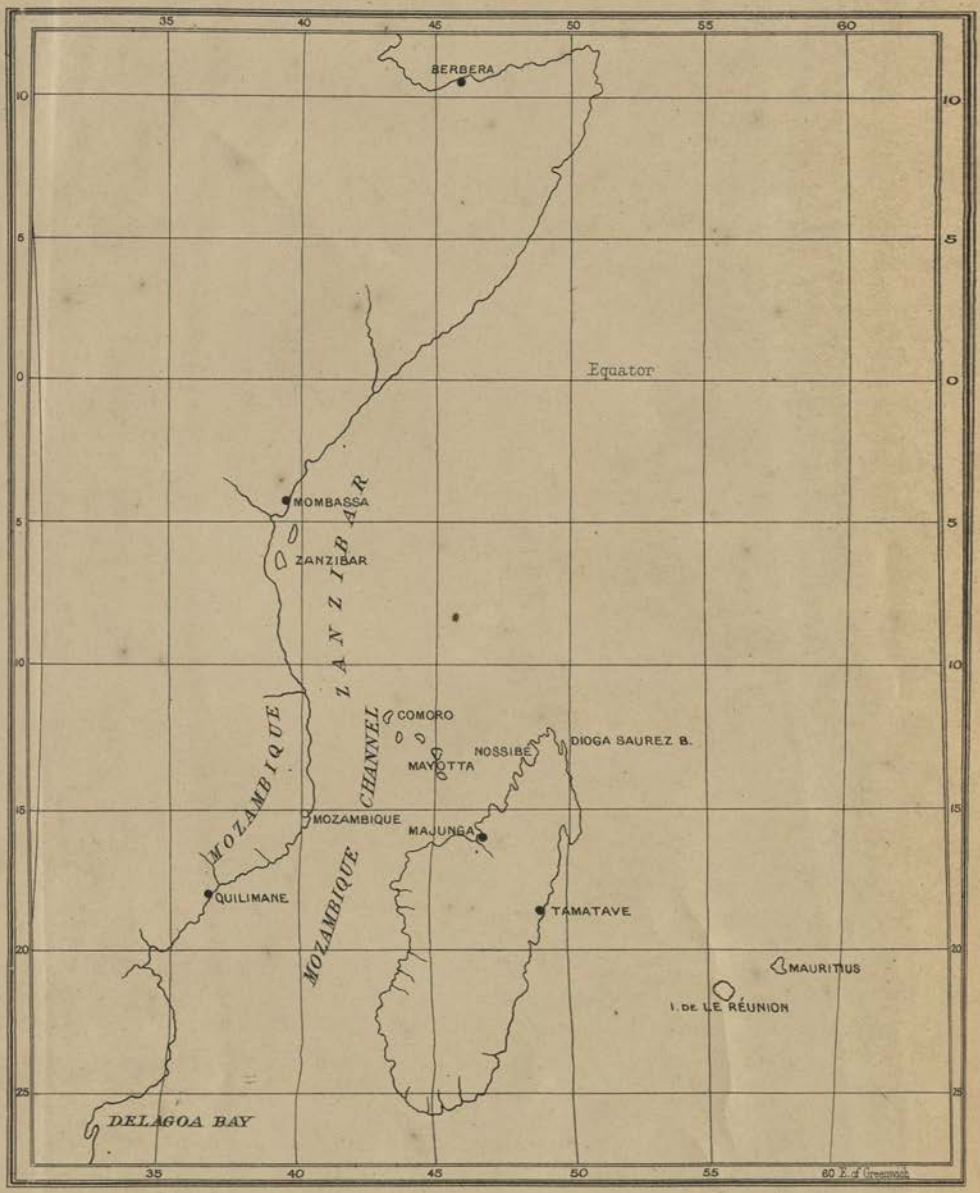
1. Tamatave is said to be infected about or after the 14th November last. It is not known that any other port in the French Colony was, either previously or at the same time, infected with the disease.
2. For fully 12 months prior to the declaration that the disease had made its appearance at Tamatave there had been, so far as steamers are concerned, no connexion whatever, either by vessels in ballast, by cargo, or by passengers, either directly or indirectly, between Bombay and any port in the French Colony of Madagascar.
3. For fully seven months prior to Tamatave being declared an infected port, the traffic by country craft from Bombay had ceased for the monsoons, and moreover, none of the native vessels which left Bombay in the early part of 1898 were bound for Tamatave.
4. It is important to note that all vessels leaving Bombay carry bills of health, stating the exact number of crew and passengers on the date of departure, and that the minimum period occupied on the voyage is, for steamers, 15 or 16 days, and, for native craft, within the most favourable condition of wind and weather, a month.

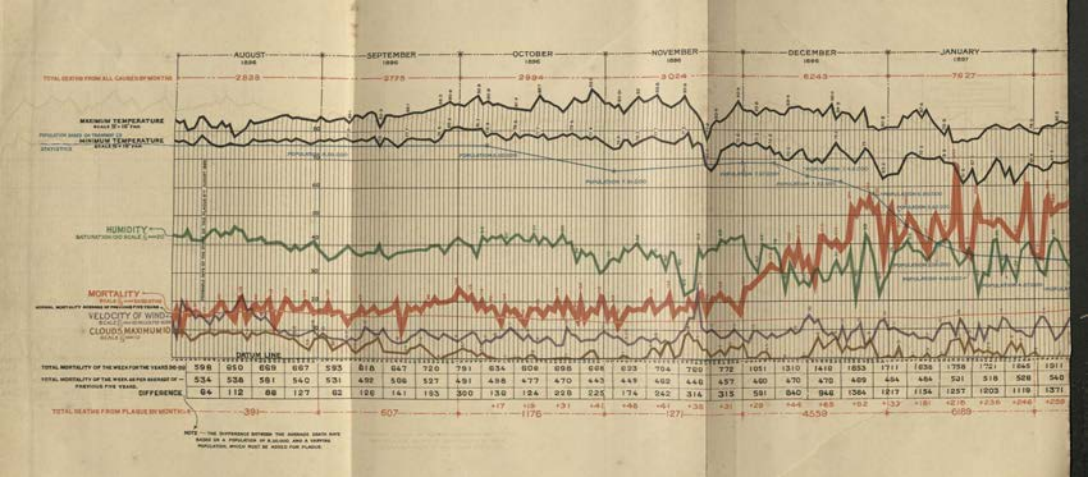
S. EVANS,
Assistant to Port Health Officer,
Bombay.

(Signed) J. CRIMMIN, V.C., Major, I.M.S.
Port Health Office, Bombay.
6th March 1899.

MAP ILLUSTRATING NOTES ON TRAFFIC BETWEEN BOMBAY AND MADAGASCAR.

(See Question No. 25,494.)




AUGUST 1896
SEPTEMBER 1896
OCTOBER 1896
NOVEMBER 1896
DECEMBER 1896
JANUARY 1897
TOTAL DEATHS FROM ALL CAUSES BY MONTHS
2828
2775
2994
3024
6243
7627
MAXIMUM TEMPERATURE
MINIMUM TEMPERATURE
HUMIDITY
MORTALITY
VELOCITY OF WIND
CLOUDS MAXIMUM
DRIVEN LINE
TOTAL MORTALITY OF THE WEEK FOR THE YEARS 90-96
598 950 669 667 593 818 647 720 791 634 608 698 698 693 704 780 772 1051 1310 1410 1853 1711 1636 1758 1721 1645 1911
TOTAL MORTALITY OF THE WEEK AS PER AVERAGE OF PREVIOUS FIVE YEARS
534 538 581 540 531 492 506 527 491 488 477 470 443 449 492 448 457 460 470 470 469 494 484 521 518 528 540
DIFFERENCE
64 112 88 127 62 126 141 193 300 130 124 228 225 174 242 314 315 591 840 940 1384 1217 1154 1237 1203 1119 1371
TOTAL DEATHS FROM PLAGUE BY MONTHS
391
607
1176
(27)
4558
6189
NOTE — THE DIFFERENCE BETWEEN THE AVERAGE DEATH RATE BASED ON A POPULATION OF 8,50,000, AND A VARYING POPULATION, WHICH MUST BE ADDED FOR PLAGUE.

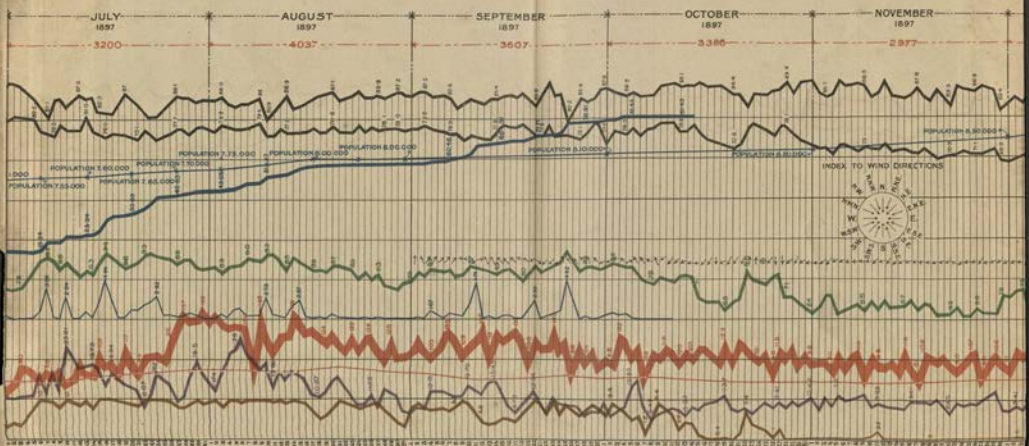
1728	1650	1484	1326	1258	1139	1141	1007	970	836	671	638	558	547	541	500	585	531	501	549
569	542	548	544	534	539	544	559	572	614	625	606	599	602	581	548	545	514	485	488
1159	1108	938	782	724	600	597	448	398	222	46	32					40	17	36	81
+276	+263	+256	245	+238	+238	+237	233	+214	+204	+171	+121	+103	+98	+89	+78	+73	+66	+59	+56
5654			4026				2828			434						462			

TOTAL 27597

BOMBAY PLA

DIAGRAM SHEWING MORTALITY AG

Prepared by Mr. C.



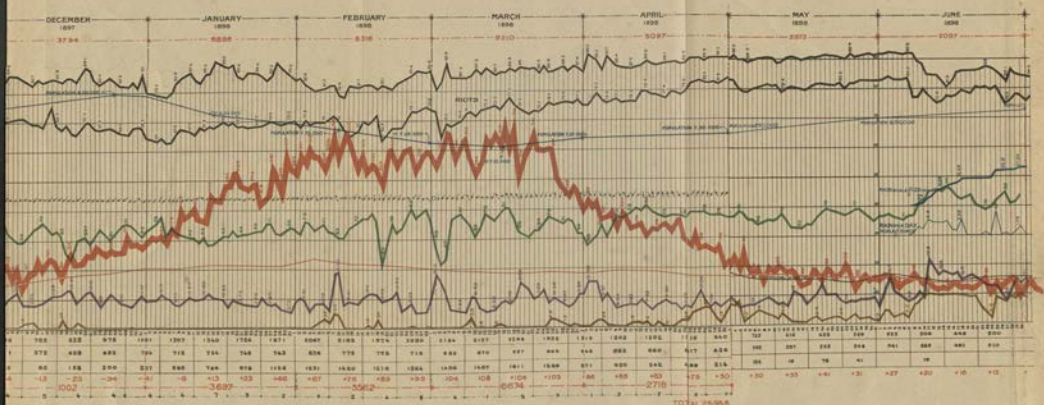
550	577	878	770	1071	985	978	866	814	838	676	869	823	776	750	776	754	741	701	700	682	704
500	491	522	548	585	558	552	600	562	552	514	518	540	531	541	514	491	496	493	495	502	514
BLOOMS CASES	4	9	14	18	8	21	13	25	33	27	35	80	44	29	48	44	44	53	47	66	70
CHOLERA CASES	+53	+54	+53	+53	+45	+37	+35	+33	+33	+28	+27	+27	+24	+22	+21	+19	+18	+18	+11	+7	+2
		1086				1697				1463				1176				883			
	15	35	32	84	220	173	143	117	76	37	41	31	29	32	12	20	22	13	11	7	8

APPENDIX No. LXXVII.
(See Question No. 26,076, 8pq.)

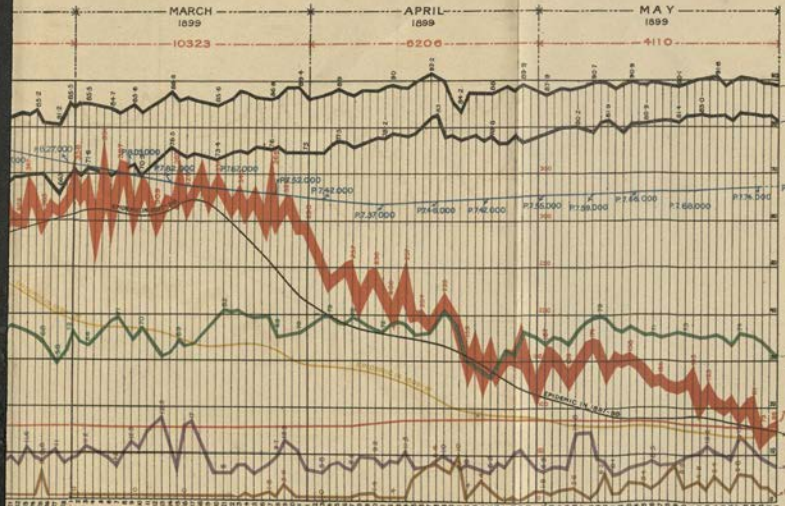
GUE VISITATION OF 1896-99

AINST TEMPERATURE, HUMIDITY, WIND-VELOCITY, CLOUD & RAIN.

C. JAMES, *M.I.C.E., Deputy Executive Engineer, Drainage, Bombay Municipality.*



JULY
1888
AUGUST
1888
SEPTEMBER
1888
OCTOBER
1888
NOVEMBER
1888
DECEMBER
1888
JANUARY
1889
FEBRUARY
1889



2249	2431	2312	2408	2290	2010	1696	1503	1305	1099	1127	1047	890	711	TOTAL MORTALITY OF THE WEEK FOR THE YEARS 1896-99.
546	544	534	539	544	559	572	614	625	606	599	602	581	545	TOTAL MORTALITY OF THE WEEK AS PER AVERAGE OF — PREVIOUS FIVE YEARS.
1703	1887	1778	1869	1746	1451	1124	889	680	493	528	445	309	166	DIFFERENCE
+15	+24	+43	+52	+58	+65	+74	+78	+77	+72	+66	+64	+57	+51	

APPENDIX No. LXXVII.
(See Question No. 26,076, sqq.)

CHART SHOWING WEEKLY DEATH RATE PER 1000 PER ANNUM ON ACTUAL POPULATION

DURING THE PLAGUE EPIDEMIC IN BOMBAY CITY IN 1896-7, 1897-8, AND 1898-9.

| | | |

APPENDIX No. LXXIX.

NOTES OF CASES OF PLAGUE

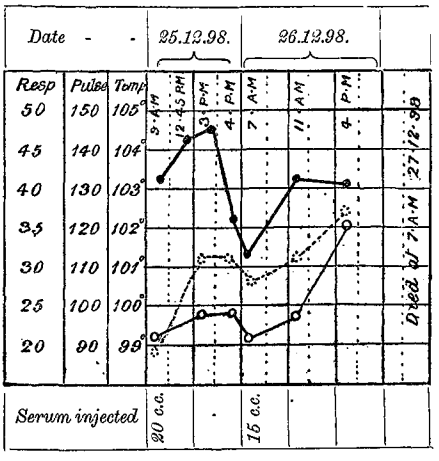
TREATED WITH

ANTI-PESTEUX SERUM FROM THE PASTEUR INSTITUTE (HORSE No. 21.)
AT BANGALORE SOUTH CAMP PLAGUE HOSPITAL.

By Lieut. S. R. DOUGLAS, I.M.S., on Special Duty with the INDIAN PLAGUE COMMISSION.

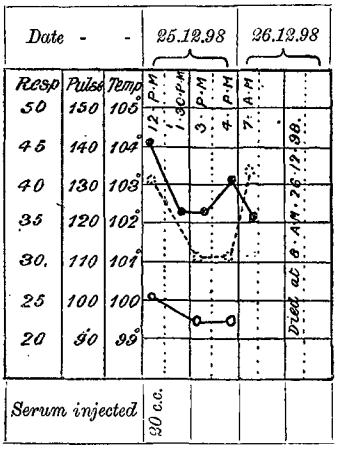
Note.—In the following charts the temperature is shown by a thick black line, the pulse by a thin black line, and the respiration by a dotted line.

CASE No. I. (Admitted on 3rd day of the disease.)



Esoph Beg. Age 45. Male. Admitted **25.12.98.** Fever for three days. Bubo in left groin. No wound of foot or leg on left side. Temperature 103·4°. Pulse 92. Good volume and tension. Respiration 20. Lungs clear. Heart normal. Spleen not felt. 20 c.c. *of serum inoculated* in left flank at 11.30 a.m. 12.45 p.m.—Temp. 104·2°. Patient volunteered the statement that pain in bubo was less. 3 p.m.—Temp. 104·6°. Pulse 96. Respiration 32. No change noticed. 4 p.m.—Temp. 102·2°. Pulse 96. Respiration 32. States that he feels better. **26.12.98.**—7 a.m.—Temp. 101·4°. Pulse 92. Respiration 28. 9 a.m.—15 c.c. *of serum inoculated* left flank. 11 a.m.—Temp. 103·4°. Pulse 96. Respiration 32. 4 p.m.—Temp. 103°. Pulse 120. Respiration 36. Delirious. Decidedly worse.

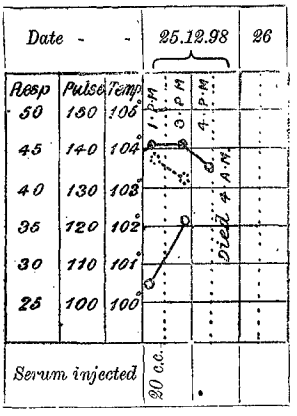
CASE No. II. (Admitted on 2nd day of the disease.)



Ala Raja (a Sais). Age 25. Male. Admitted **25.12.98.** Fever for two days, bubo one day. Bubo in right axilla and also the glands above the clavicle on the same side; a good deal of swelling round it. Temperature 104. Pulse 100. Respirations 40. Tongue brown furred. 20 c.c. *of serum inoculated* (10 c.c. into each flank) at 12.0 p.m. 1.30 p.m.—Temp. 102·4°. 3 p.m.—Temp. 102·4°. Pulse 96. Respiration 32. 4 p.m.—Temp. 103°. Pulse 96. Respiration 32. **26.12.98.**—7 a.m.—Temp. 102·2°. Pulse running; could not be counted. Respiration 44.

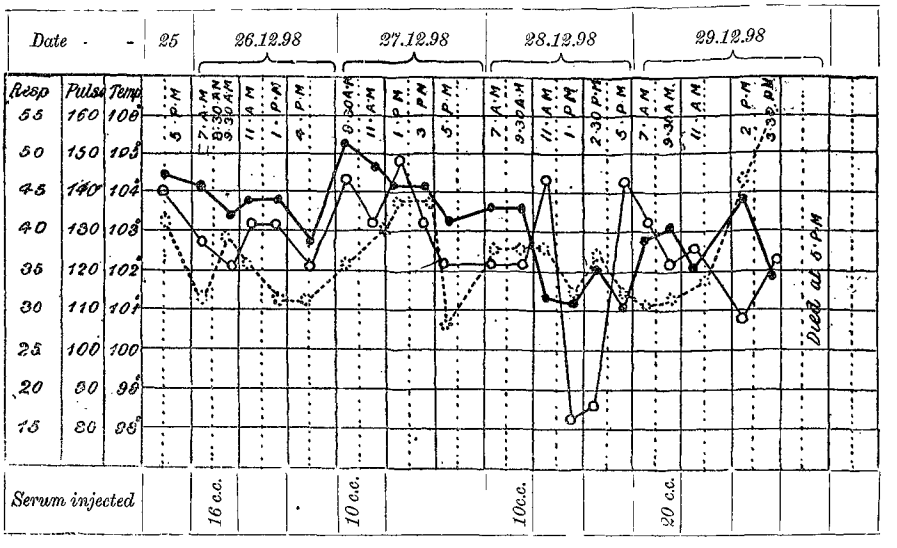
25.12.98.—One case not inoculated as he had a suppurating bubo and was convalescent.

CASE No. III. (Admitted on 3rd day of the disease.)



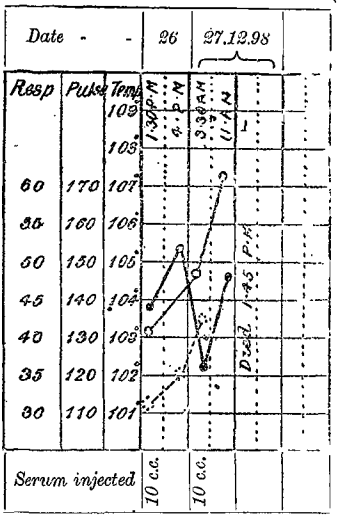
Willammah. Female. Age 25. Admitted **25.12.98.** Fever for three days, had not noticed any bubo. Temperature on admission 99°, patient shivering. Pulse very fast and weak. One ounce of arrack given, and one hour afterwards (1 p.m.) temperature was 104°. Pulse 104, weak and irregular in time and force. Respiration 44. Slightly delirious. Tongue furred; indented at edges. Spleen not felt. Bubo in right axilla. Heart and lungs normal. Left breast very prominent and hard, as if pushed forward by something. 20 *c.c. of serum inoculated* into left flank (1 p.m.). 3 p.m.—Temp. 104°. Pulse 120, distinctly stronger. Respiration 42. 4 p.m.—Temp. 103·8°. Slightly better pulse, but much muscular twitching was present, the head never being still. Patient seemed sensible and quiet.

CASE No. IV. (Admitted on 3rd day of the disease.)



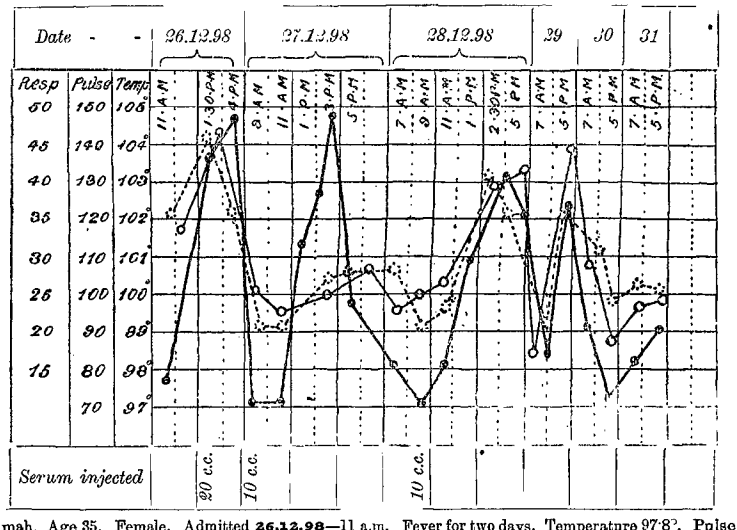
Barkli Amma. Age 20. Female. Admitted **25.12.98** (evening). Fever for two days. Temperature 104·4°. Pulse 140. Respiration 42. Bubo in right axilla. A small suppurating wound, a scratch received three days before illness on inner side of left forearm. Cover-slip preparations taken stained with fuchsin, but nothing resembling a plague bacillus seen. Numerous encapsuled diplococci present. An agar tube inoculated from wound. Cover-slip from tube two colonies, one round, opaque, yellowish, showed cocci in groups; the other smooth, thin, when magnified consisting of minute colonies, showed diplococci in chains. **26.12.98.**—7 a.m.—Temp. 104°. Pulse 128. Respiration 32. 8.30 a.m.—Heart and lungs normal. Spleen not felt. Tongue furred; indented at edges. 16 *c.c. serum inoculated* into right flank. 9.30 a.m.—Temp. 103·6°. Pulse 120. Respiration 40. 11.0 a.m.—Temp. 103·8°. Pulse 132. Respiration 36. 1.0 p.m.—Temp. 103·8°. Pulse 132. Respiration 32. 4.0 p.m.—Temp. 102·8°. Pulse 120. Respiration 32. **27.12.98.**—8.30 a.m.—Temp. 105·2°. Pulse 144. Respiration 36. Looks very much better, quiet and sensible. 10 *c.c. serum inoculated.* 11.0 a.m.—Temp. 104·8°. Pulse 132. Respiration 42. 1.0 p.m.—Temp. 104·4°. Pulse 148. Respiration 44. 3.0 p.m.—Temp. 104·2°. Pulse 132. Respiration 44. Not quite so sensible, but pulse fairly good. 5.0 p.m.—Temp. 103·4°. Pulse 122. Respiration 48. **28.12.98.**—7.0 a.m.—Temp. 103·6°. Pulse 120. Respiration 36. 9.30 a.m.—Temp. 103·6°. Pulse 120, not so strong. Respiration 36. Slightly delirious. 10 *c.c. inoculated* 11.0 a.m.—Temp. 101·2°. Pulse 144. Respiration 36. 1.0 p.m.—Temp. 101·2°. Pulse 92. Respiration 32 2.30 p.m.—Temp. 102°. Pulse 96. Respiration 36. Slightly delirious. 5.0 p.m.—Temp. 101°. Pulse 142. Respiration 32. **29.12.98.**—7.0 a.m.—Temp. 102·8°. Pulse 132. Respiration 30. 9.30 a.m.—Temp. 103°. Pulse 120. Respiration 32. Answered sensibly when spoken to, but restless and talks much to herself. 20 *c.c. inoculated.* 11.0 a.m.—Temp. 102°. Pulse 124. Respiration 36. 2.0 p.m.—Temp. 103·8°. Pulse 108. Respiration 46. 3.30 p.m.—Temp. 102·6. Pulse 120. Respiration 56. Bronchial breathing at left apex. General condition bad. No sputum obtainable. Pulse very weak.

CASE No. V. (Admitted on 2nd day of the disease.)



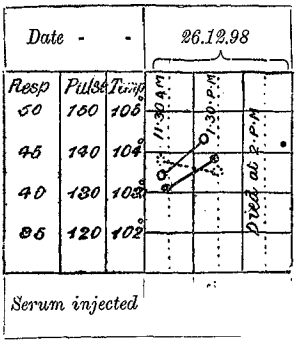
Poopathi. Age 8. Female. Admitted **26.12.98.** Bubo noticed yesterday. Fever came on last night. Bubo in right groin. Temperature 103·8°. Pulse 130. Respiration 32. 1.30 p.m.—No wound discovered on right leg or buttock. 10 *c.c. of serum inoculated.* Spleen not felt. 4 p.m.—Temp. 105·4°. Pulse 148. Respiration 35. **27.12.98.**—8.30 a.m.—Temp. 102. Pulse 180 running very weak. Respiration 43. General condition much worse. A good deal of muscular twitching. 10 *c.c. of serum inoculated* into right flank. 11 a.m.—Temp. 104·8°. Pulse running.

CASE No. VI. (Admitted on 3rd day of the disease.)



Balamah. Age 35. Female. Admitted **26.12.98**—11 a.m. Fever for two days. Temperature 97·8°. Pulse 116. Respiration 35. 1.30 p.m.—Shivering much; talking incoherently. No bubo; heart and lungs normal. Tongue brown; furred. Teeth very dirty, and covered with brown sordes. Temperature 103·6°. Cover-slip of blood taken. Blood preparation stained with eosin and methylene blue. No bacilli of any sort seen, but some malarial parasites present. Pulse, so much muscular tremor that it could not be counted (rigor). Respiration 46. Spleen not felt. 20 *c.c. of serum inoculated* into left flank. 4 p.m.—Temp. 104·6°, Pulse 144. Respiration 36. **27.12.98**—8 a.m.—Temp. 97°. Pulse 100. Respiration 20. Patient looks much better. Tongue still very foul. 10 *c.c. inoculated.* 11 a.m.—Temp. 97°. Pulse 96. Respiration 20. 1 p.m.—Temp. 101·4°. Pulse could not be taken on account of muscular tremor (rigor). 3 p.m.—Temp. 104·6°. Pulse 100. Respiration 27. Pulse very good considering temperature, and remarkably slow. 5 p.m.—Temp. 99·8°. Pulse 108. Respiration 28. **28.12.98.**—7 a.m.—Temp. 98°. Pulse 96. Respiration 28. 9 a.m.—Temp. 97°. Pulse 100. Respiration 20. 10 *c.c. inoculated.* 11 a.m.—Temp. 98°. Pulse 104. Respiration 24. 1 p.m.—Temp. 101; shivering much. Pulse and respiration could not be taken. 2.30 p.m.—Temp. 103·2°. Pulse 128. Respiration 40. Still shivering but skin moist. 5 p.m.—Temp. 102. Pulse 132. Respiration 36. **29.12.98.**—7 a.m.—Temp. 98·4°. Pulse 84. Respiration 22. 9.30 a.m.—Quite comfortable; looks like a severe case of malaria. No serum inoculated, but Quinine, gr., X. ordered at once; and to be repeated when sweating stage was reached. 5 p.m.—Temp. 103·2°. Pulse 140°. Respiration 35. **30.12.98.**—7 a.m.—Temp. 99°. Pulse 108. Respiration 36. 5 p.m.—Temp. 97·2°. Pulse 88. Respiration 24. **31.12.98.**—7 a.m.—Temp. 98·2°. Pulse 98. Respiration 26. 5 p.m.—Temp. 99° Pulse 100. Respiration 24. 9 a.m.—Temp. 97. Pulse 72. Respiration 20. Convalescent.

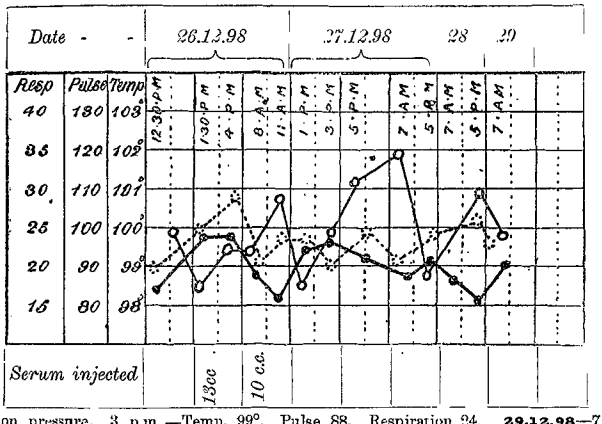
26.12.98. One not inoculated as she had had a large abscess on the middle of the right thigh for 12 days. This abscess had burst, laying bare the muscle, and a large slough was protruding. Over the head of the left fibula was another abscess. Patient very ill with high temperature. Very foul brown tongue. (?) Plague in carbuncular form.



CASE No. VII. (Admitted on 2nd day of the disease.)

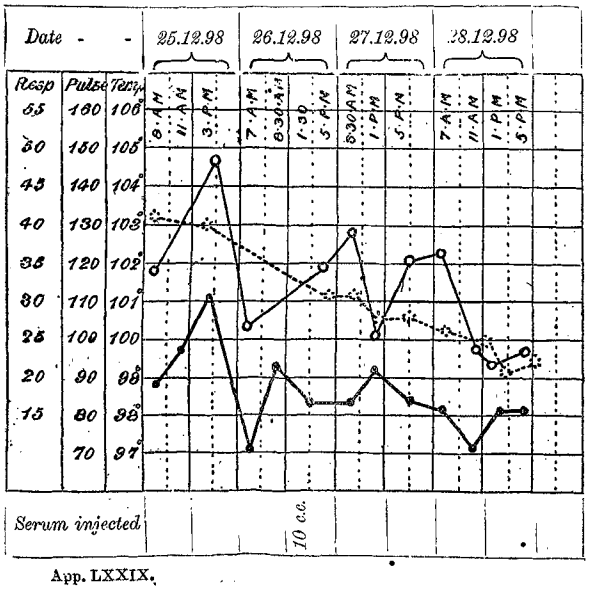
Almail. Age 30. Female. Admitted **26.12.98**—11.30 a.m. Fever only one day. Bubo in right groin. No wound discovered. Temperature 103°. Pulse 132. Respiration 44. 1.30 p.m.—General condition very bad, 5½ months pregnant. Temp. 103·8°. Pulse 144, weak and irregular. Respiration, gasping, 44. Patient very restless. Heart and lungs normal as far as could be ascertained. 17 *c.c. of serum injected* into left flank. 2 p.m.—Died (half hour after injection). Practically moribund on admission.

CASE No. VIII. (Admitted on 6th day of the disease.)



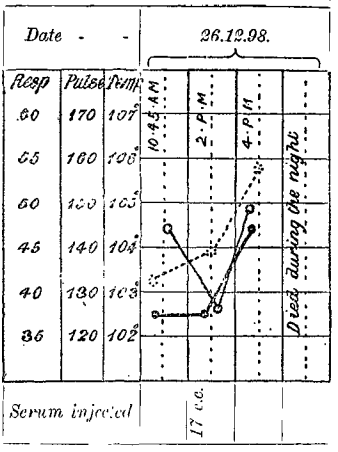
Lutchmee. Age 13. Female. Admitted **26.12.98**. 12.30 p.m. Five days ago fever. Four days ago bubo noticed. Temp. 98·4°. Pulse 100. Respiration 20. 1.30 p.m.—Tongue slightly furred. Lungs and heart normal. Bubo in right inguinal and also right femoral glands. No wound of right leg or foot discovered. General condition good. Spleen not enlarged. Temp. 99·8°. Pulse 84. Respiration 24. 13 *c.c. of serum inoculated* into right flank. 4 p.m.—Temp. 99·8°. Pulse 98. Respiration 28. General condition very good. **27.12.98.**—8 a.m.—Temp. 98·8°. Pulse 96. Respiration 22. Looks quite well. 10 *c.c. inoculated*. 11 a.m.—Temp. 98·2°. Pulse 108. Respiration 24. 1 p.m.—Temp. 99·4°. Pulse 84. Respiration 23. 3 p.m.—Temp. 99·6°. Pulse 96. Respiration 20. 5 p.m.—Temp. 99·2°. Pulse 112. Respiration 25. **28.12.98.**—7 a.m.—Temp. 98·8°. Pulse 120. Respiration 20. Seems quite well. Not injected. 2.30 p.m.—Bubo still present but scarcely tender on pressure. 3 p.m.—Temp. 99°. Pulse 88. Respiration 24. **29.12.98**—7 a.m.—Temp. 98·6°. Pulse 88. Respiration 22. Convalescent. 5 p.m.—Temp. 98°. Pulse 110. Respiration 26. **30.12.98.**—7 a.m.—Temp. 99. Pulse 98. Respiration 24. Bubo still present. Removed to convalescent ward. **1.1.99.**—Bubo suppurating, opened.

CASE No. IX. (Admitted on 3rd day of the disease.)



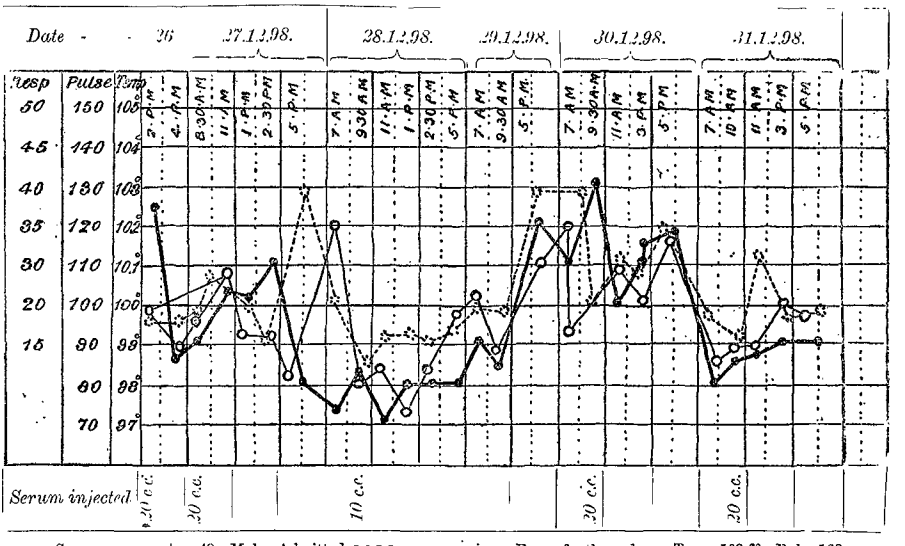
Beersi. Age 12. Female. Admitted **25.12.98**: early morning. Two days fever. Temperature 98·8°. Pulse 118. Respiration 42. Râles and rhonchi heard over the whole of the right lung, a few over the left. No bubo found. 11 a.m.—Temp. 99·6°. 3 p.m.—Temp. 101°. Pulse 148. Respiration 40. Tongue covered with a thin layer of white fur, rather flabby. **26.12.98.**—7 a.m.—Temp. 97°. Pulse 102. Respiration 36. 8.30 a.m.—No cough or sputum. General condition good. Temp. 99·4°. Pulse fair volume and tension. Tongue covered with white fur, indented at the edges ("typical plague tongue"). 1.30 p.m.—10 *c.c. serum inoculated* into left flank. 4 p.m.—Temp. 98·4°. Pulse 120, good. Respiration 32. **27.12.98**—8.30 a.m.—Temp. 98·4. Pulse 128. Respiration 32. 1 p.m.—Temp. 99·2. Pulse 100. Respirations 28. No serum given. 5 p.m.—Temp. 98·4°. Pulse 120. Respiration 28. **28.12.98.**—7 a.m.—Temp. 98°. Pulse 122. Respiration 26. No inoculation. 11 a.m.—Temp. 97°. Pulse 96. Respiration 24. 1 p.m.—Temp. 98°. Pulse 92. Respiration 22. 2.30 p.m.—Practically convalescent. A few squeaks heard in the lungs. 5 p.m.—Temp. 98. Pulse 96. Respiration 24. **29.12.98**—7 a.m.—Temp. 98·4°. Pulse 84. Respiration 22. Convalescent.

CASE No. X. (Admitted on 3rd day of the disease.)



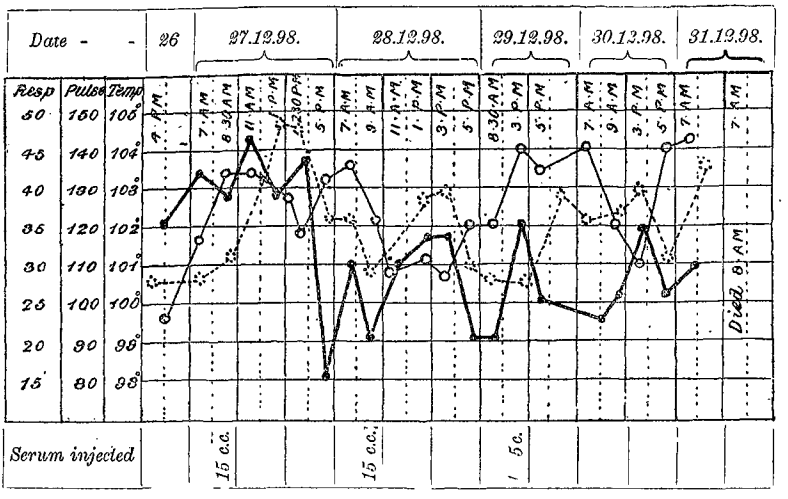
Gnana Moothoo. Aged 40. Male. Admitted **26.12.98** 10.45. a.m. Fever and bubo for two days. Temp. 102·6°. Respirations 42. Pulse 116. 2 p.m.—General condition bad, Much muscular tremor. A very large submaxillary bubo filling up the whole space between the jaw and the clavicle on the left side; the œdema spreading far down on to the chest. Temp. 102·6°. Pulse 124. Respiration 44. Great difficulty in swallowing and unable to open the mouth more than about half an inch, so that the condition of the inside of the mouth could not be observed. Spleen not enlarged. Heart and lungs normal. 17 *c.c. of serum inoculated* into left flank. 4 p.m.—Temp. 104·6°. Respiration 54. Pulse 148.

CASE No. XI. (Admitted on 4th day of the disease.)



Sewasagayan. Age 48. Male. Admitted **26.12.98** : morning. Fever for three days. Temp. 102·6°. Pulse 100. Respiration 24. 2 p.m.—General condition fair. Tongue furred, brown, indented at edges. Eyes bloodshot, tears running over the face in large quantities. Heart and lungs normal. Bubo in left inguinal region, no wound found. 20 *c.c. of serum inoculated* in left flank. 4 p.m.—Temp. 98·8°. Pulse 88. Respiration 24. **27.12.98.**—8.30 a.m.—Glands enlarged on both sides of the neck to a slight degree, more especially on the right side. Temp. 99°. Pulse 96. Respiration 24. 20 *c.c. serum inoculated.* 11 a.m.—Temp. 100·4°. Pulse 108. Respiration 28. 1 p.m.—Temp. 100·2°. Pulse 92. Respiration 25. 2.30 p.m.—Temp. 101°. Pulse 92. Respiration 20. General condition the same. No worse. 5 p.m.—Temp. 98°. Pulse 84. Respiration 40. **28.12.98.**—7 a.m.—Temp. 97·6°. Pulse 120. Respiration 25. 9.30 a.m.—Temp. 98·4°. Pulse 80. Respiration 16. 10 *c.c. inoculated.* Patient feels quite well. 11 a.m.—Temp. 97°. Pulse 84. Respiration 22. 1 p.m.—Temp. 98. Pulse 72. Respiration 23. 2.30 p.m.—Temp. 98°. Pulse 84. Respiration 20. 5 p.m.—Temp. 98°. Pulse 96. Respiration 22. **29.12.98.**—7 a.m.—Temp. 99°. Pulse 102. Respiration 25. 9.30 a.m.—Temp. 98·4°. Pulse 88. Respiration 24. Bubo small, very slightly tender. Not inoculated. 5 p.m.—Temp. 102°. Pulse 110. Respiration 40. **30.12.98.**—7 a.m.—Temp. 101°. Pulse 120. Respiration 40. 9.30 a.m.—Temp. 103°. Pulse 92. Respiration 24. 20 *c.c. inoculated.* 11 a.m.—Temp. 100°. Pulse 108. Respiration 28. 3 p.m.—Temp. 101·4°. Pulse 100. Respiration 28. 5 p.m.—Temp. 101·8°. Pulse 118. Respiration 34. **31.12.98.**—7 a.m.—Temp. 98°. Pulse 84. Respiration 24. 10 a.m.—Temp. 98·4°. Pulse 88. Respiration 20. 20 *c.c. inoculated.* 11 a.m.—Temp. 98·6°. Pulse 88. Respiration 32. 3 p.m.—Temp. 99°. Pulse 100. Respiration 23. Patient says he feels quite well, bubo the same size, very little surrounding œdema. 5 p.m.—Temp. 99°. Pulse 88. Respiration 24. **1.1.99.**—7 a.m.—Temp. 98°. Pulse 88. Respiration 18. Convalescent.

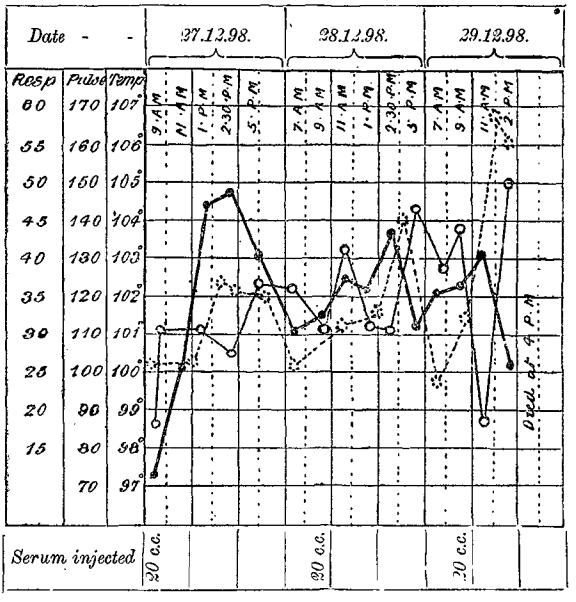
CASE No. XII. (Admitted on 3rd day of the disease.)



Goondappah. Aged 12 (looks much younger). Male. Admitted 4 p.m., **26.12.98.** Two days ago fever, one day ago bubo. On admission, temperature 102°. Pulse 98. Respiration 28. **27.12.98.**—7 a.m.—Temp. 103·4°. Pulse 118. Respiration 28. 8.30 a.m.—Temp. 102·8°. Pulse 132. Respiration 32. Tongue furred. Spleen not felt. Heart and lungs normal. Slight cough. No sputum. Bubo in right axilla. Not delirious. General condition, fair. 15 *c.c. inoculated.* Wound on right foot suppurating; seven days old. 11 a.m.—Temp. 104·2°. Pulse 132. Respiration 42. 1 p.m.—Temp. 102·8°. Pulse 128. Respiration 48. 2.30 p.m.—Temp. 103·8°. Pulse 116. Respiration 48. 5 p.m.—Temp. 98°. Pulse 132. Respiration 36. **28.12.98.**—7 a.m.—Temp. 101°. Pulse 136. Respiration 36. General condition, good; rather better than yesterday. 9 a.m.—Temp. 99°. Pulse 120. Respiration 28. 15 *c.c. of serum inoculated* into left flank. 11 a.m.—Temp. 101°. Pulse 108. Respiration 27. 1 p.m.—Temp. 101·4°. Pulse 110. Respiration 38. 3 p.m.—Temp. 101·4°. Pulse 108. Respiration 40. General condition very good. Lungs clear. 5 p.m.—Temp. 99°. Pulse 120. Respiration 30. Bubo smaller, not so painful. **29.12.98.**—8.30 a.m.—Temp. 99°. Pulse 120. Respiration 28. Tongue clean. General condition very good, so not inoculated. 3 p.m.—Temp. 102°. Pulse 140. Respiration 28. Skin moist, tongue clean. 15 *c.c. inoculated* on account of rise of temperature. 5 p.m.—Temp. 100°. Pulse 136. Respiration 40. **30.12.98.**—7 a.m.—Temp. 99·6°. Pulse 140. Respiration 36. 9 a.m.—Temp. 100·2°. Pulse 120. Respiration 36. Peevish sleeps continually. Tongue clean. 3 p.m.—Temp. 102°. Pulse 110. Respiration 40. A small bleb* has formed over the site of bubo surrounded by a purplish spot, much œdema round the bubo. 5 p.m.—Temp. 99·6°. Pulse 140. Respiration 25. **31.12.98.**—7 a.m.—Temp. 101°. Pulse 144. Respiration 48. The glands on both sides of the neck have enlarged during the night.

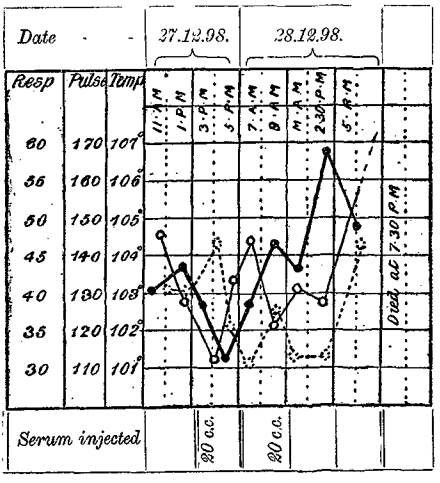
* A cover-slip preparation was taken from this bleb, which contained clear serum, and showed numerous bacilli, more or less shapeless masses. An agar tube was also inoculated.

CASE No. XIII. (Admitted on 5th day of the disease.)



Tukajee Rao. Age 25. Male. Admitted **27.12.98.**—9 a.m. Fever and bubo for four days. Patient staggering like a drunken man. Eyes suffused, unsteady voice, very dull. Pupils contracted. Temperature 98·4°. Pulse 96. Respiration 32. Bubo, one in right groin and another in right axilla; no wound found. Heart normal. Lungs, râles and rhonchi (principally rhonchi) and sibilus in left lung. Spleen could not be felt. 20 *c.c. inoculated.* 11 a.m.—Temp. 101°. Pulse 120. Respiration 32. 1 p.m.—Temp. 105·4°. Pulse 120. Respiration 44. 2.30 p.m.—Temp. 105·6°. Pulse 116. Respiration 40. 5 p.m.—Temp. 104°. Pulse 134. Respiration 40. **28.12.98.**—7 a.m.—Temp. 102·2°. Pulse 132. Respiration 30. 9 a.m.—Patient very restless and delirious. Tongue dry and brown. Pupils contracted. Temp. 102·6°. Pulse 120. Respiration could not be taken. 20 *c.c. inoculated.* 11 a.m.—Temp. 103·6°. Pulse 144. Respiration 36. 1 p.m.—Temp. 103·2°. Pulse 126. Respiration 38. 2.30 p.m.—Temp. 104·4°. Pulse 120; irregular in time. Respiration not taken on account of excessive talking, very restless; had to be tied in bed. 5 p.m. — Temp. 102·4°. Pulse 156. Respiration 50. **29.12.98.**—7 a.m.—Temp. 103°. Pulse 136. Respiration 28. Very delirious all night, did not sleep. 9 a.m.—Temp. 103·2°. Pulse 148. Respiration 36. 20 *c.c. inoculated.* Talking incessantly, pulse very weak. Lungs, squeaks heard. 11 a.m.—Temp. 104°. Pulse 96. Respiration 76. 2 p.m.—Temp. 101°. Pulse 160. Respiration 60. Bronchial breathing at both apices, especially the left, base of lungs clear, moribund. A cover glass preparation taken of sputum half hour before death stained with eosine and methylene blue, large quantities of diplococci and other micro-organisms seen and two small groups of polar staining bacilli. A cover glass preparation of the blood taken at the same time showed no bacilli or cocci. 4 p.m.—Had a long convulsion and died.

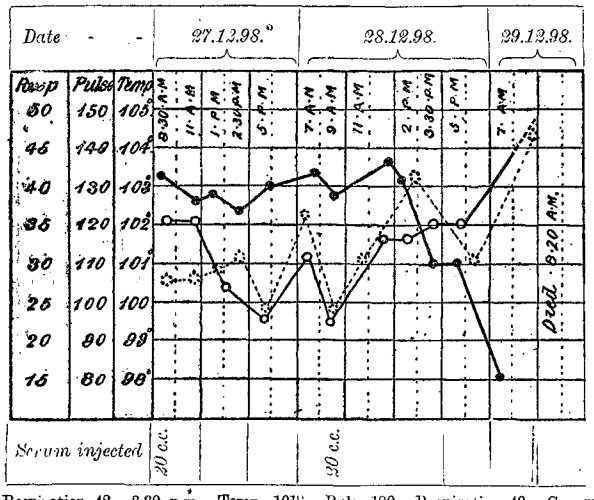
CASE No. XIV. (Admitted on 3rd day of the disease.)



Ramiah. Aged 15. Admitted **27.12.98.**—11 a.m. Fever and bubo two days. Temperature 103°. Pulse 144. Respiration 40. 1 p.m.—Temp. 103·4°. Pulse 128. Respiration 38. 3 p.m.—General condition moderate, dull, stupid. Bubo in right femoral glands. No wound detected. Heart and lungs normal. Eyes suffused. Spleen not felt. Temp. 102·8°. Respiration 48. Pulse 112. 20 *c.c. of serum inoculated* into right flank. 5 p.m.—Temp. 101·6°. Pulse 132. Respiration 35. **28.12.98.**—7 a.m. Temp. 102·8°. Pulse 144. Respiration 32. 9 a.m.—Temp. 104·6°. Pulse 120, very irregular in time and force. Respiration 36. Delirious. Tongue dry. 20 *c.c. inoculated.* 11 a.m.—Temp. 103·8°. Pulse 132. Respiration 32. 1 p.m.—Temp., &c. not able to be taken on account of violent delirium. 2.30 p.m.—Temp. 106·6°. Patient sponged, before which he was dull, apathetic, not answering when spoken to, but afterwards talked rationally, answering questions. Respiration 32. Pulse 128. 5 p.m.—Temp. 104·8°. Pulse running could not be counted. Respiration 148.

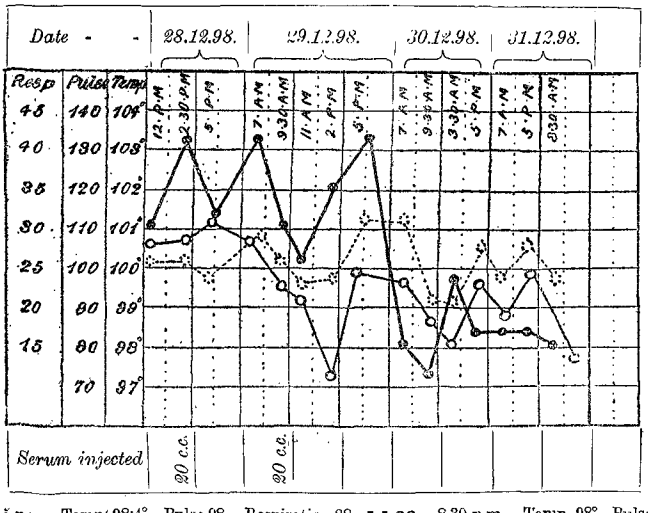
CASE No. XV. (Admitted on ? day of the disease.)

Mooniamah. Aged 55. Female. Admitted **27.12.98.**—7.30 p.m. History, none obtainable. So violently delirious that no temperature or other observations could be obtained. **28.12.98.**—8.30 a.m.—General condition bad. Very delirious still, but not violent, talking much, occasional slight cough. Tongue could not be seen. Eyes very suffused. Temp. 103.2°. Pulse 120. Respiration 28. 20 *c.c. inoculated.* Speen not felt. No bubo could be found. 11 a.m.—Temp. 102·6°. Pulse 120. Fair volume and tension. Respiration 28. 1 p.m.—Temp. 102·8°. Pulse 120. Respiration 30. 2.30 p.m. — Temp. 102·4°. Pulse 104. Respiration 32. Heart and lungs normal. 5 p.m.—Temp. 103°. Pulse 98. Respiration 24. **29.12.98.**—7 a.m.—Temp. 103·4°. Pulse 112. Respiration 36. 9 a.m.—Temp. 102·8°. Pulse 96. Respiration 24. Patient quiet but dull, no delirium, but will not put out her tongue when told to, which, however, does not look nearly so dry and cracked. No bubo found. 20 *c.c. of serum inoculated.* 11 a.m.—Temp. 103·6°. Pulse 116. Respiration 32. 2 p.m. —Temp. 103·2°. Pulse 116. Respiration 42. 3.30 p.m.—Temp. 101°. Pulse 120. Respiration 40. General condition fair. 5 p.m.—Temp. 101°. Pulse 120. Respiration 30. **30.12.98.**—7 a.m.—Temp. 98°. Pulse running could not be counted. Respiration 48.

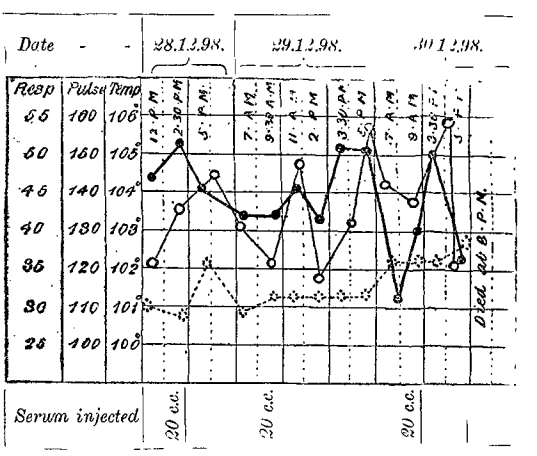


CASE XVI. (Admitted on 2nd day of the disease.)

Nagamah. Age 50. Female. Admitted **28.12.98.**—12 p.m. Fever for day. Temperature 101°. Pulse 108 Respiration 26. 2.30 p.m.—General condition fair. Heart and lungs normal. Quite sensible. Spleen not felt. Tongue red at the tip; slight fur. Bubo in the left axilla not noticed before admission. Temp. 103·4°. Pulse 108. Respiration 26. 20 *c.c. inoculated* into left flank. 5 p.m.—Temp. 101·4°. Pulse 112. Respiration 24. **29.12.98.**—7a.m.—Temp. 102·2°. Pulse 108. Respiration 28. 9.30 a.m.—Temp. 101°. Pulse 96. Respiration 26. General condition good. Bubo not painful. 20 *c.c. inoculated.* 11 a.m. — Temp. 100·2°. Pulse 92. Respiration 23.2 p.m.—Temp. 102.° Pulse 72. Respiration 24. Pulse good: patient seems in a very good condition. 5 p.m.—Temp. 103·4°. Pulse 100. Respiration 32. **30.12.98.**—7 a.m.—Temp. 98°. Pulse 96. Respiration 32. 9.30 a.m.—Temp. 97·4°. Pulse 86. Respiration 20. Feels quite well. 3.30 p.m. —Temp. 99·8°. Pulse 80. Respiration 20. 5 p.m.—Temp. 98.4°. Pulse 96. Respiration 28. **31.12.98.**—7 a.m. — Temp. 98·4°. Pulse 86. Respiration 24. 5 p.m.—Temp. 98·4°. Pulse 98. Respiration 28. **1.1.99.**—8.30 p.m.—Temp. 98°. Pulse 76. Respiration 24. Bubo present but not painful. Convalescent.

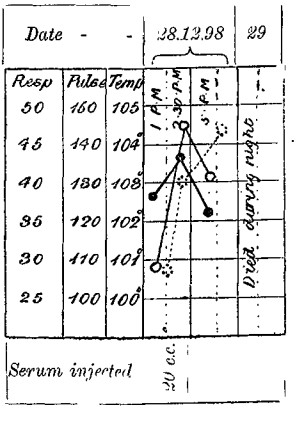


CASE XVII. (Admitted on 2nd day of the disease.)



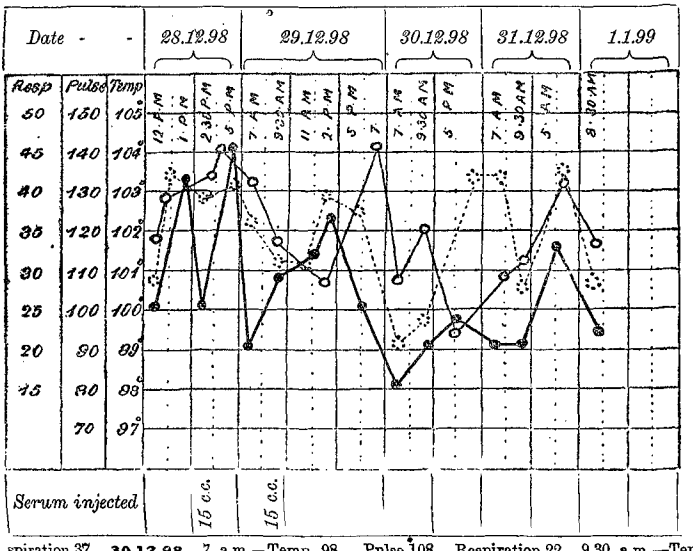
Gnanama. Age 28. Female. Admitted **28.12.98.** 12 p.m.—Taken ill yesterday; bubo noticed last night. Temperature 104·2°. Pulse 120. Respiration 30. 2.30 p.m.—General condition fair. Heart and lungs clear. Temp. 105·2°. Pulse 132. Respiration 28. Distinct bubo in right groin. Pain complained of in left inguinal region. Small glands felt. Spleen could not be felt. Tongue furred, dry. 20 *c.c. inoculated* into left flank. 5 p.m. —Temp. 104°. Pulse 144. Respiration 36. **29.12.99.**—7 a.m.—Temp. 103·4°. Pulse 132. Respiration 28. 9.30 a.m. —Temp. 103·4°. Pulse 120. Respiration 32. No enlargement of glands or pain felt in the left groin; right bubo unchanged. General condition fair. 20 c.c. *inoculated*. 11 a.m.—Temp. 104°. Pulse 148. Respiration 32. 2 p.m.—Temp. 103·4°. Pulse 118. Respiration 32. 3.30 p.m.— Temp. 105·2°. Pulse 132; weak, and very hard to count. Respiration 32. 5 p.m.— Temp. 105°. Pulse 156. Respiration 32. **30.12.98.**—7a.m.—Temp.101·2°. Pulse 134. Respiration 36. 9 a.m.—Temp. 103°. Pulse 128. Respiration 36. Dull, slightly delirious. Pulse very small. 20 *c.c. inoculated*. 3.30 p.m. —Temp. 105°. Pulse 156. Respiration 36. 5 p.m.—Temp. 102·4°. Pulse 110. Respiration 38. **31.12.98.**— Violently delirious all night. 6 a.m. —Died.

CASE No. XVIII. (Admitted on 7th day of the disease.)



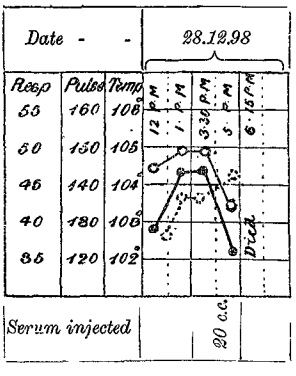
Muriamah. Age 60. Female. Admitted **28.12.98.** Fever for six days. Temperature 102·8°. Pulse 108. Respiration 28. 2.30 p.m.— General condition very bad. Sensible but very weak. Tongue brown and dry, stuffed the roof of the mouth. Temp. 103·6°. Pulse 144. Respiration 40. Shallow. Pulse very small but regular. Bubo in left groin. No wound could be found. Heart normal, but sounds very weak. Lungs congested at the bases. 20 *c.c. of serum inoculated* into left flank. Practically moribund. 5 p.m.—Temp. 102·2 Pulse 130. Respiration 48.

CASE No. XIX. (Admitted on 6th day of the disease.)



Coopoo Sawmy. Age 11. Male. Admitted **28.12.98.**—12 p.m. Fever for five days. Temperature 100°. Pulse 118. Respiration 28. 1 p.m.—Temp. 103·4°. Pulse 128. Respiration 42. 2.30 p.m.—General condition good. Heart and lungs normal. Spleen could not be felt. Quite sensible. Bubo in left femoral glands. No wound could be found. Temp. 100°. Pulse 134. Respiration 40. 15 *c.c. inoculated* into left flank. 5 p.m.—Temp. 104°. Pulse 140. Respiration 42. **29.12.98.**—7 a.m.—Temp. 99°. Pulse 132. Respiration 36. 9.30 a.m.—Temp. 100·8° Pulse 118. Respiration 32. 15 *c.c. inoculated.* General condition good. Bubo unchanged. 11 a.m.—Temp. 101·6°. Pulse 112. Respiration 32. 2 p.m.—Temp. 102·4°. Pulse 108. Respiration 40. Quite sensible, feels fairly well. 5 p.m.—Temp. 100°. Pulse 144. Respiration 37. **30.12.98.**—7 a.m.—Temp. 98. Pulse 108. Respiration 22. 9.30 a.m.—Temp. 99°. Pulse 120. Respiration 24. Feels quite well. Not inoculated. Bubo still present. 5 p.m.—Temp. 99·8°. Pulse 94. Respiration 44. **31.12.98.**—7 a.m.—Temp. 99°. Pulse 108. Respiration 44. 9.30 a.m.—Temp. 99°. Pulse 112. Respiration 28. 5 p.m.—Temp. 101·8°. Pulse 133. Respiration 44. **1.1.99.**—8.30 a.m.—Temp. 99·2°. Pulse 116. Respiration 28.

CASE No. XX. (Admitted on 6th day of the disease.)

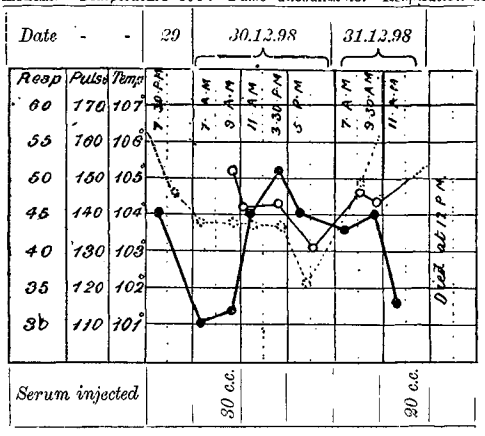


Hanmantha. Age 35. Male. Admitted **28.12.98.**—12 p.m. Fever for four or five days. Bubo for three days. Temperature 102·8°. Pulse 144. Respiration 38. 1 p.m.—Temp. 104·2°. Pulse 148. Respiration 44. 3.30 p.m.—General condition bad. Very dull and apathetic, but answering rationally when spoken to. Quiet, lying still. Tongue very furred, white. Bubo in right femoral region. No wound found. Spleen could not be felt. Temp. 104·2°. Pulse 148. Respiration 44. 20 *c.c. of serum inoculated* into left flank. 5 p.m.—Temp. 102·2°. Pulse 132. Respiration 46.

28.12.98.—One patient was admitted at the same time as cases Nos. XVI. to XX., but died almost immediately afterwards, and was not seen by me.

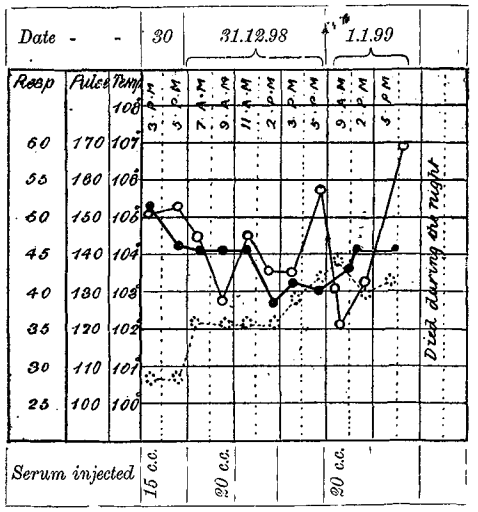
CASE No. XXI. (Admitted on 8th day of the disease.)

Nursamah. Age 25. Female. Admitted **29.12.98.**—7.30 p.m. Fever for eight days, and also pain in the left popliteal space. Six days ago swelling noticed in left axilla. Four days ago aborted. Fœtus about four months. Temperature 104°. Pulse uncountable. Respiration 48.



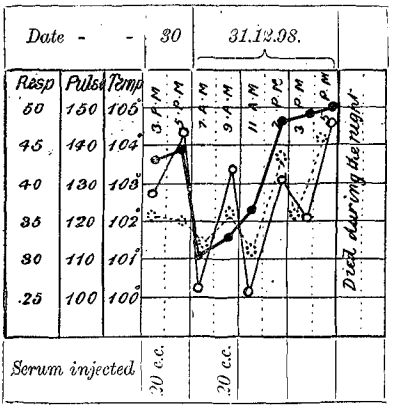
30.12.98.—7 a.m.—Temp. 101. Pulse uncountable. Respiration 44. 9 a.m.—General condition bad. Tongue very clean considering. Pulse very rapid but fair volume. Buboes in left axilla and left popliteal space. No wound found. No offensive discharge from the vagina or pain on pressing the lower part of the belly. Temperature 101·6°. Pulse 152. Respiration 44. 30 *c.c. of serum inoculated.* 11 a.m.—Temp. 104·4°. Pulse 140. Respiration 44. 3.30 p.m.—Temp. 105·2°. Pulse 144. Respiration 44. Left lung dull on percussion. Bronchial breathing heard over dull area. A preparation stained with fuchsin showed numerous bipolar stained bacilli, also pneumococci and cocci. An agar tube was inoculated. Sputum in small quantities very like ordinary pneumonic sputum, but contained more blood colouring matter. 5 p.m.—Temp. 104°. Pulse 130. Respiration 52. **31.12.98.**—7 a.m.—Temp. 103·6°. Pulse 148. Respiration 48. 9.30 a.m.—Temp. 104°. Pulse 44. Respiration 56. No sputum brought up. 20 *c.c. inoculated* 11 a.m.—Temp. 101·6°. Pulse running.

CASE No. XXII. (Admitted on 2nd day of the disease.)



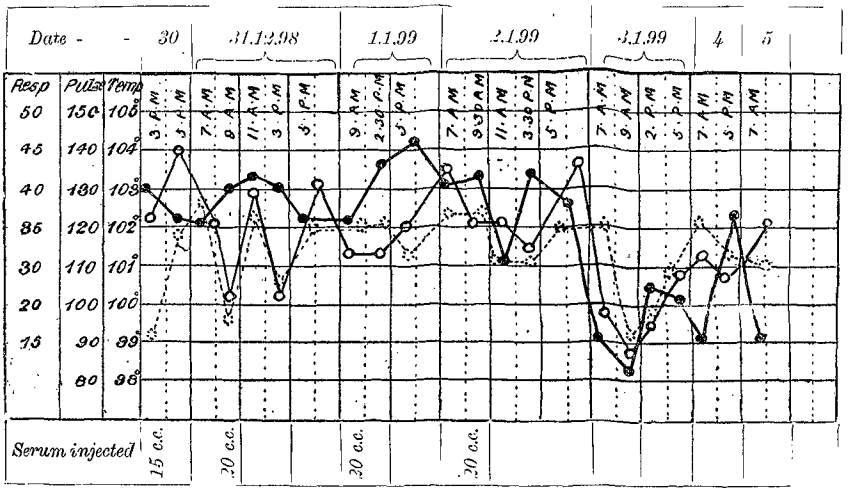
Ummanee. Age 11. Female. Admitted **30.12.98.**—2 p.m. Fever came on yesterday. Bubo appeared during the night. Temperature 105·4°. Pulse 152. Respiration 28. 3 p.m.—Very dull and apathetic. Heart and lungs clear. Tongue could not be seen. Bubo in left axilla. No wound. 15 *c.c. inoculated.* 5 p.m.—Temp. 104·2°. Pulse 154. Respiration 28. **31.12.98.**—7 a.m.—Temp. 104. Pulse 144. Respiration 36. 9 a.m.—Temp. 104°. Pulse 128. Respiration 36. 20 *c.c. inoculated.* 11 a.m.—Temp. 104°. Pulse 144. Respiration 36. 2 p.m.—Temp. 102·8°. Pulse 136. Respiration 36. 3 p.m.—Temp. 103·2°. Pulse 132. Respiration 40. 5 p.m.—Temp. 103°. Pulse 156. Respiration 42. **1.1.99.**—9 a.m.—Temp. 103·6°. Pulse 120. Respiration 44. 20 *c.c. inoculated.* 2 p.m.—Temp. 104. Pulse 132. Respiration 40. 5 p.m.—Temp. 104. Pulse 170. Respiration 42.

CASE No. XXIII. (Admitted on 5th day of the disease.)



Janakiammah. Age 13. Female. Admitted **30.12.98.**—2 p.m. Four days ago fever and bubo. 3 p.m.—General condition bad. Very restless and delirious. Bubo beneath left sterno mastoid. Tongue furred, white and dry. Tonsil could not be seen. Heart and lungs clear. Temp. 105·3°. Pulse 128. Respiration 36. 20 *c.c. inoculated* after much struggling. 5 p.m.—Temp. 104°. Pulse 144. Respiration 35. **31.12.98.**—7 a.m.—Temp. 101°. Pulse 104. Respiration 32. 9 a.m.—Temp. 101·4°. Pulse 136.—Respiration 36. General condition very bad. 20 *c.c. inoculated.* Very delirious; quieter. Pulse very weak. 11 a.m.—Temp. 102·4°. Pulse 100. Respiration 32. 2 p.m.—Temp. 104·4°. Pulse 132. Respiration 44. 3 p.m.—Very delirious, trying to get out of bed. Temp. 104·8°. Pulse 120. Respiration 36. 30 grs. of Potassi. Bromid. ordered. 5 p.m.—Temp. 105°. Pulse 148. Respiration 46.

CASE No. XXIV. (Admitted on 2nd day of the disease.)

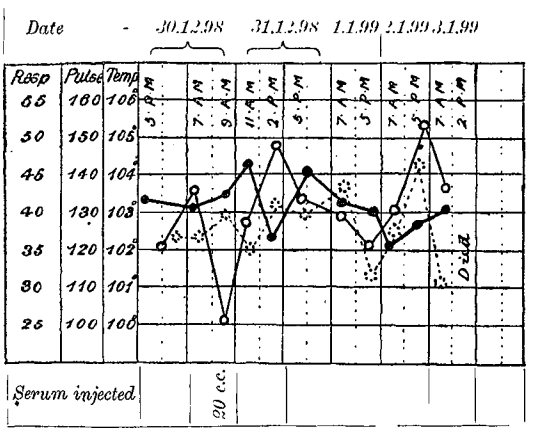


Munanee Amal. Aged 9. Fever. Sister of Case No. XXIII. Admitted **30.12.98.**—2 p.m. Fever for one day. 3 p.m.—Dull, apathetic. No bubo. Heart and lungs clear. Tongue, white fur. Temp. 103°. Pulse 122. Respiration 20. 15 *c.c. inoculated.* 5 p.m.—Temp. 102·4°. Pulse 140. Respiration 35. **31.12.98.**—7 a.m.—Temp. 102°. Pulse 120. Respiration 38. 9 a.m.—Temp. 103°. Pulse 104. Respiration 24. Bubo on right side of neck beneath the upper part of sterno mastoid. Tongue fairly clean. Still dull. 20 *c.c. inoculated.* 11 a.m.—Temp. 133·2°. Pulse 120. Respiration 36. 3 p.m.—Temp. 103°. Pulse 104. Respiration 28. Sensible, but dull. 5 p.m.—Temp. 102·4°. Pulse 132. Respiration 36. **1.1.99.**—9 a.m.—Temp. 10·2°. Pulse 116. Respiration 36. 20 *c.c. inoculated.* Seems better. Bubo in right axilla. 2.30 p.m.—Temp. 103·6°. Pulse 116. Respiration 36. Much brighter. 5 p.m.—Temp. 104·2°. Pulse 120. Respiration 32. **2.1.99.**—7 a.m. Temp. 103°. Pulse 132. Respiration 36. 9.30 a.m.—Temp. 103·2°. Pulse 120. Respiration 36. Better. 20 *c.c. inoculated.* 11 a.m. Temp. 101°. Pulse 120. Respiration 30. 3.30 p.m.—Temp. 103·4°. Pulse 116. Respiration 30. Condition about the same, no worse. 5 p.m.—Temp. 102·8°. Pulse 136. Respiration 36. **3.1.99.**—7 a.m.—Temp. 99°. Pulse 98. Respiration 36. 9 a.m.—Temp. 98·4°. Pulse 88. Respiration 20. Not inoculated. 2 p.m.—Temp. 100·8°. Pulse 96. Respiration 24. 5 p.m.—Temp. 100·4°. Pulse 108. Respiration 20. **4.1.99.**—7 a.m.—Temp. 99. Pulse 112. Respiration 36. 5 p.m.—Temp. 102·4°. Pulse 108. Respiration 32. **5.1.99.**—7 a.m.—Temp. 99·2°. Pulse 120. Respiration 30.

30.12.98.—Two other cases were admitted about this time, one a small child with a suppurating bubo, the other a man with a normal temperature, who complained of pains all over, which had been present for 10 days.

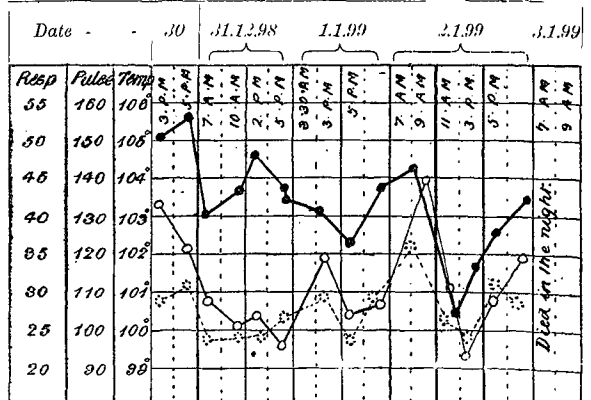
CASE No. XXV. (Admitted on 6th day of the disease.)

Santhiamal. Age 25. Female. Admitted **30.12.98.**—12 p.m. Illness for five days. 3 p.m.—Cold in the head. Heart normal. Râles, rhonchi, and whistling over both lungs. Most marked at left base. No sputum. 5 p.m.—Temperature 103·2. Pulse 120. Respiration 36. **31.12.98.**—7 a.m.—Temp. 103. Pulse 132. Respiration 36. 9 a.m.—Temp. 103·4°. Pulse 100. Respiration 40. 20 *c.c. inoculated.* 11 a.m.—Temp. 104·2. Pulse 128. Respiration 34. 2 p.m. Temp. 102·6. Pulse 148. Respirations 42. 5 p.m.—Temp. 104. Pulse 136. Respiration 40. **1.1.99.**—7 a.m.—Temp. 103·2°. Pulse 130. Respiration 44. 5 p.m.—Temp. 103. Pulse 120. Respiration 32. This case does not seem at all like a plague case, there being no marked symptoms of depression, not inoculated in consequence. **2.1.99.**—7 a.m.—Temp. 102°. Pulse 130. Respiration 36. 5 p.m.—Temp. 102·8°. Pulse 156. Respiration 46. Does not look very serious, pulse good, although fast; vomited a round worm. **3.1.99.**—7 a.m.—Temp. 103°. Pulse 132. Respiration 30. Still coughing, râles and rhonchi in lungs. Not so well.

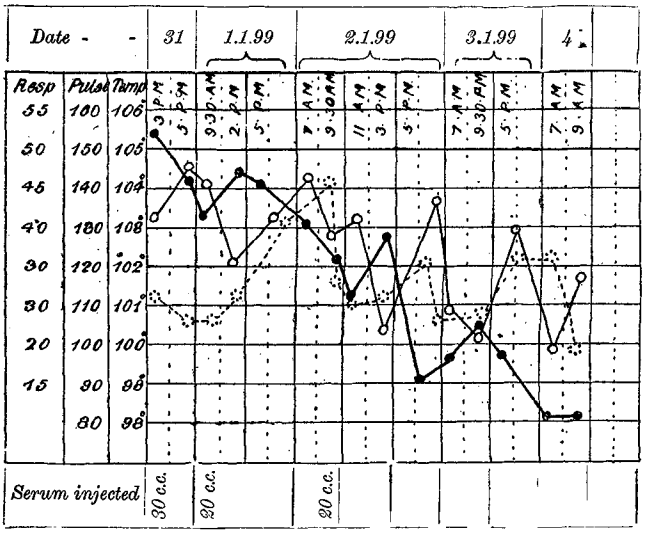


CASE No. XXVI. (Admitted on 2nd day of the disease.)

Chumappu. Age 27. Male. Admitted **30.12.98.**—1 p.m. Yesterday evening fever and bubo in left groin. 3 p.m.—Dull, quiet. Heart and lungs clear. Bubo in left groin. Tongue furred, white. Temperature 105. Pulse 132. Respiration 28. 30 *c.c. inoculated.* 5 p.m.—Temp. 105·6. Pulse 120. Respiration 32. **31.12.98.**—7 a.m.—Temp. 103. Pulse 108. Respiration 24. 10 a.m.—Temp. 103·8. Pulse 100. Respiration 24. General condition improved. 20 *c.c. inoculated.* 11 a.m.—Temp. 103·8. Pulse 94. Respiration 28. 2 p.m.—Temp. 104·8°. Pulse 104. Respiration 24. 3 p.m.—Temp. 103·6. Pulse 96. Respiration 26. 5 p.m.—Temp. 103·2. Pulse 120. Respiration 30. **1.1.99.**—8.30 a.m.—Temp. 102·6. Pulse 104. Respiration 24. 20 *c.c. inoculated.* 3 p.m.—Temp. 103·8°. Pulse 108. Respiration 28. Very restless, has to be tied into bed. 5 p.m.—Temp. 104·2°. Pulse 140. Respiration 36. **2.1.99.**—7 a.m.—Temp. 100·2°. Pulse 110. Respiration 26. 9 a.m.—Temp. 101·6. Pulse 92. Respiration 24. Much quieter, very weak, rapidly losing flesh. 20 *c.c. inoculated.* 11 a.m.—Temp. 102·6. Pulse 108. Respiration 30. 3 p.m.—Temp 103·4. Pulse 120. Respiration 28. Delirious, but not violent. **3.1.99.**—9 a.m.—Very bad, pulse not perceptible at the wrist. About 160. Respiration sighing, slow. Temp. 102. 20 *c.c. inoculated.* 2 p.m.—Still living, but moribund.

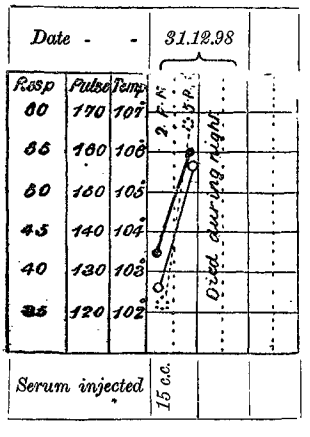


CASE No. XXVIII. (Admitted on 4th day of the disease.)



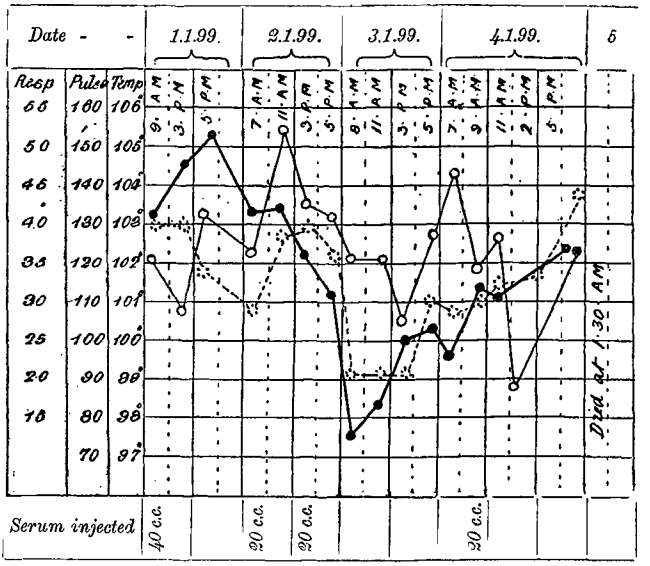
Ramabai. Age 25. Female. Admitted **31.12.98.**—1 p.m. Fever for three or four days. Bubo for two days. 3.0 p.m.—Tongue furred, white. General condition fair, but rather restless. Heart and lungs clear. Bubo in right axilla. Temp. 105·3°. Pulse 132. Respiration 32. 30 *c.c. inoculated.* 5.0 p.m.—Temp. 104·2. Pulse 144. Respiration 28. **1.1.99.**—9.30 a.m.—Temp. 103·2. Pulse 140. Respiration 28. Complains of much pain in bubo. 20 *c.c inoculated.* 2.0 p.m.—Temp. 104·4°. Pulse 120. Respiration 32. General condition very fair. 5.0 p.m.—Temp. 104°. Pulse 134. Respiration 42. Slightly delirious. **2.1.99.**—7.0 a.m.—Temp. 103°. Pulse 144. Respiration 48. 9.30 a.m.—Temp. 102·2°. Pulse 128. Respiration 34. General condition good; complains of much pain in the bubo. 20 *c.c. inoculated* (under protest). 11.0 a.m.—Temp. 101·4°. Pulse 132. Respiration 32. 3.0 p.m.—Temp. 102·8°. Pulse 104. Respiration 32. Seems better. 5.0 p.m.—Temp. 99°. Pulse 136. Respiration 36. **3.1.99.**—7.0 a.m.—Temp. 99·8°. Pulse 108. Respiration 28. 9.30 a.m.—Temp. 100·4°. Pulse 104. Respiration 28. Not inoculated; much better; bubo still painful. 2.0 p.m.—Sleeping quietly. 5.0 p.m.—Temp. 99·8°. Pulse 130. Respiration 36. **4.1.99.**—7.0 a.m.—Temp. 98°. Pulse 98. Respiration 36. 9.0 a.m.—Temp. 98°. Pulse 116. Respiration 24.

CASE No. XXIX. (Admitted on ? day of the disease.)



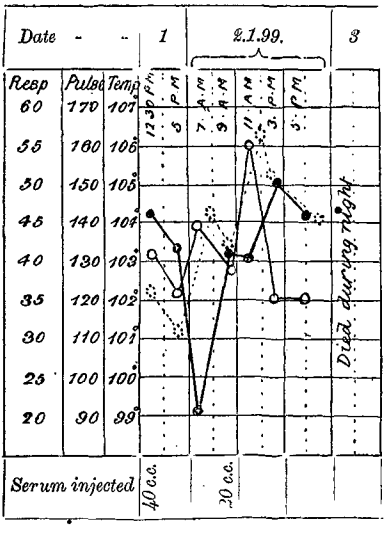
Kavariamah. Aged 2. Female. Admitted **31.12.98.**—10.30 a.m. History.—None. Temp. 103·2°. Pulse 124. Respiration 36. General condition bad, constantly shaking her head, and grinding teeth. 2.0 p.m.—15 *c.c. inoculated* into buttock. 5.0 p.m.—Temp. 106°. Pulse 156. Respiration 58.

CASE No. XXX. (Admitted on 5th day of the disease.)



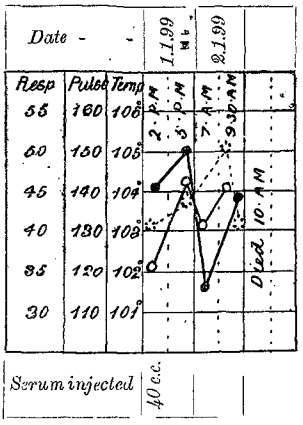
Kupram Rajoo. Aged. Male. Admitted **1.1.99.**—9 a.m. Fever for four days. Two days ago bubo in right groin. One day ago bubo on left side of the neck. General condition, very bad indeed. Pulse very weak and irregular, 120. Temperature 103·4°. Respiration 40. Never still, tendons at wrist continually twitching. Low muttering delirium. Might die at any time. 40 *c.c. injected.* 3 p.m.—Temp. 104·4°. Pulse 108. Respiration 40. Pulse stronger. 5 p.m.—Temp. 105·2°. Pulse 132. Respiration 34. **2.1.99.**—7 a.m.—Temp. 103·4. Pulse 122. Respiration 28. 9.30 a.m.—Rather better. 20 *c.c. inoculated.* 11 a.m.—Temp. 103·6°. Pulse 156. Respiration 38. 3 p.m.—Temp. 102·2°. Pulse 136. Respiration 40. Condition much the same; not sensible, but quiet. 20 *c.c. inoculated.* 5 p.m.—Temp. 101·2°. Pulse 132. Respiration 36. **3.1.99.**—8 a.m.—Temp. 97·8°. Pulse 120. Respiration 20. Very much better; pulse much stronger; patient exceedingly feeble. Not inoculated. 11 a.m.—Temp. 98·4°. Pulse 120. Respiration 20. 3 p.m.—Temp. 100°. Pulse 104. Respiration 20. Very weak, but sensible; pulse better. 5 p.m.—Temp. 100·2°. Pulse 128. Respiration 30. **4.1.99.**—7 a.m.—Temp. 99·6°. Pulse 144. Respiration 28. 9 a.m.—Temp. 101·6°. Pulse 108. Respiration 30. Not quite so well. 20 *c.c. inoculated.* 11 a.m.—Temp. 101°. Pulse 128. Respiration 32. 2 p.m.—Temp. 101·8. Pulse 88. Respiration 34. 5 p.m.—Temp. 102·4. Pulse 124. Respiration 44.

CASE No. XXXI. (Admitted on 6th day of the disease.)



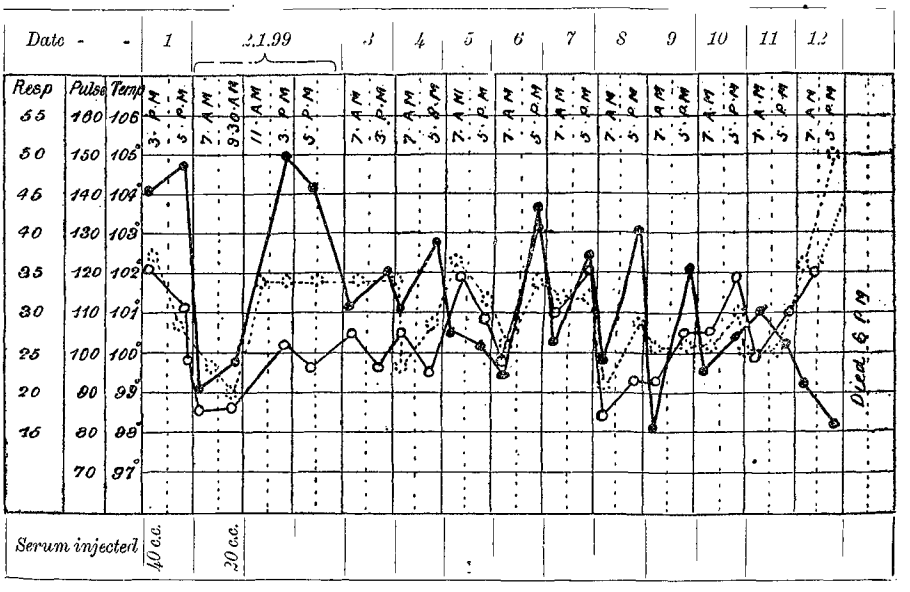
Mooniswamy. Age 18. Male. Admitted **1.1.99.**—12.30 p.m. Fever for three days. Cough for four days. Temperature 104·2°. Pulse 132. Respiration 36. 3 p.m.—General condition not good. Small wound on right forearm. Bubo in right epitrochlear glands. Lungs: Left lung diminished resonance, increased vocal vibrations, and bronchial breathing. Right lung practically normal; a few râles heard at base. 40 *c.c. inoculated.* 5 p.m.—Temp. 103·6°. Pulse 120. Respiration 30. **2.1.99.**—7 a.m.—Temp. 99°. Pulse 140. Respiration 46. 9 a.m.—Temp. 103·2°. Pulse 128. Respiration 42. Right lung involved in disease, marked bronchial breathing and coarse râles. No sputum obtained. 20 *c.c. inoculated.* 11 a.m.—Temp. 103°. Pulse 160. Respiration 56. 3 p.m.—Temp. 105·2°. Pulse 120. Respiration 52. Very bad. 5 p.m.—Temp. 104·2°. Pulse 120. Respiration 45.

CASE No. XXXII. (Admitted on 6th day of the disease.)



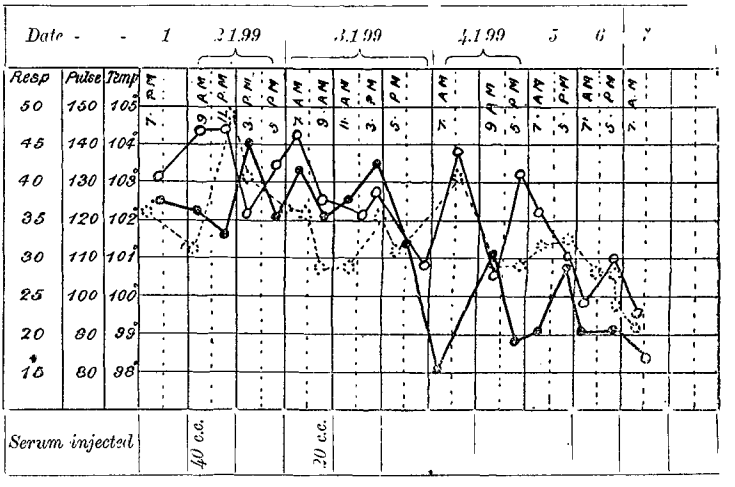
Thinakah. Age 35. Female. Admitted **1.1.99.** Fever for 5 days, and pain in left groin for the same time. 2 p.m.—General condition fair. Heart and lungs normal. 40 *c.c. inoculated.* Very small bubo in left femoral region. Temperature 104°. Pulse 120. Respiration 40. 5 p.m.—Temp. 105°. Pulse 144. Respiration 44. **2.1.99.**—7 a.m.—Temp. 101·6°. Pulse 130. Respiration 50. 9.30 a.m.—Temp. 103·8°. Pulse 140, not perceptible at the wrist. Respiration 40. Moribund.

CASE No. XXXIII. (Admitted on 1st day of the disease.)



Perrinbavahma. Age 55. Mother of XXIII. and XXIV. Admitted 3 p.m.—**1.1.99.** Has been nursing her children in hospital. This afternoon vomited twice, no rigor. Complains of headache. Tongue furred. No bubo or pain in site of any set of glands. Temperature 104°. Pulse 120. Respiration 36. 40 *c.c. inoculated.* 5 p.m.—Temp. 104·6°. Pulse 110. Respiration 28. **2.1.99.**—7 a.m.—Temp. 99°. Pulse 88. Respiration 24. 9.30 a.m.—Temp. 99·8°. Pulse 88. Respiration 20. 20 *c.c. inoculated.* 11 a.m.—Temp. 102·6°. Pulse 96. Respiration 36. 3 p.m.—Temp. 105°. Pulse 104. Respiration 36. No bubo. 5 p.m.—Temp. 104·2°. Pulse 98. Respiration 36. **3.1.99.**—7 a.m.—Temp. 101·2°. Pulse 108. Respiration 36. 5 p.m.—Temp. 102. Pulse 98. Respiration 36. **4.1.99.**—7 a.m.—Temp. 101°. Pulse 108. Respiration 24. 5 p.m.—Temp. 102·8°. Pulse 98. Respiration 28. **5.1.99.**—7 a.m.—Temp. 100·8°. Pulse 120. Respiration 36. Feels quite well. 5 p.m.—Temp. 100°. Pulse 108. Respiration 32. **6.1.99.**—7 a.m.—Temp. 99·4°. Pulse 96. Respiration 26. 5 p.m.—Temp. 103·8°. Pulse 132. Respiration 35. **7.1.99.**—7 a.m.—Temp. 100·2°. Pulse 108. Respiration 30. 5 p.m.—Temp. 102·6°. Pulse 120. Respiration 32. **8.1.99.**—7 a.m.—Temp. 99·8°. Pulse 84. Respiration 22. 5 p.m.—Temp. 103°. Pulse 96. Respiration 28. **9.1.99.**—7 a.m.—Temp. 98°. Pulse 96. Respiration 25. 5 p.m.—Temp. 102·2°. Pulse 108. Respiration 26. **10.1.99.**—7 a.m.—Temp. 99·6°. Pulse 108. Respiration 26. 5 p.m.—Temp. 100·2°. Pulse 120. Respiration 30. **11.1.99.**—7 a.m.—Temp. 101°. Pulse 96. Respiration 25. 5 p.m.—Temp. 100·2°. Pulse 110. Respiration 25. **12.1.99.**—7 a.m.—Temp. 99·2°. Pulse 120. Respiration 30. From the 5th to this date, although patient had had some fever every night, she always stated that she felt quite well. Quinine had been administered, but in no way affected the temperature. When seen at 9 a.m., patient was breathing rapidly and laboriously, râles and rhonchi were heard over both lungs; in the afternoon patient's condition was much worse, she was, however, quite conscious, dulness was not complete on percussing the chest. 5 p.m.—Temp. 98·2. Pulse running. Respiration 50. No sputum could be obtained.

CASE No. XXXIV. (Admitted on 4th day of the disease.)

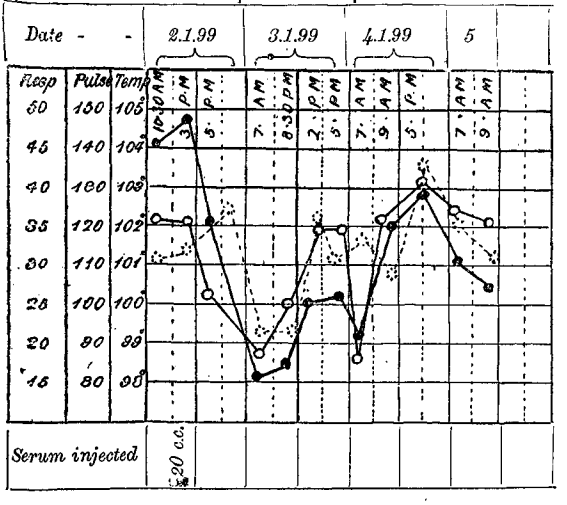


Runga. Age 14. Male. Admitted **1.1.99.** evening. Ill for three or four days. Temperature 102·8°. Pulse 130. Respiration 36. **2.1.99.**—7 a.m.—Temp. 102·4°. Pulse 144. Respiration 33. General condition fair. Heart and lungs normal. No bubo found. 40 *c.c. inoculated.* 11 a.m.—Temp. 101·6°. Pulse 144. Respiration 48. 3 p.m.—Temp. 104°. Pulse 120. Respiration 40. Complains of a pain in the belly. ? inoculation. 5 p.m. —Temp. 102°. Pulse 136. Respiration 36. **3.1.99.**—7 a.m.—Temp. 103·4°. Pulse 144. Respiration 36. 9 a.m. —Temp. 102°. Pulse 120. Respiration 28. 20 *c.c. inoculated.* No bubo. Slight cough. Sputum mucopus. 11 a.m.—Temp. 102·6°. Pulse 120. Respiration 28. 2.30 p.m.—Temp. 103·4°. Pulse 128. Respiration 36. General condition good. 5 p.m.—Temp. 101·2°. Pulse 108. Respiration 32. **4.1.99.**—7 a.m.—Temp. 98°. Pulse 136? Respiration 42. 9 a.m.—Temp. 101·2°. Pulse 116. Respiration 28. 5 p.m.—Temp. 98·8°. Pulse 132. Respiration 28. 5.1.99.—7 a.m.—Temp. 99°. Pulse 122. Respiration 32 5 p.m.—Temp. 100·8°. Pulse 108. Respiration 32. **6.1.99.**—7 a.m.—Temp. 99°. Pulse 98. Respiration 26. 5 p.m.—Temp. 99°. Pulse 110. Respiration 28. **7.1.99.**—7 a.m.—Temp. 98·4°. Pulse 96. Respiration 24.

1.1.99.—Two other cases admitted. One had had an abortion four days ago, and now had a slight temperature. The other was a very old woman, who had no bubo, and nothing to indicate plague in any way. Died.

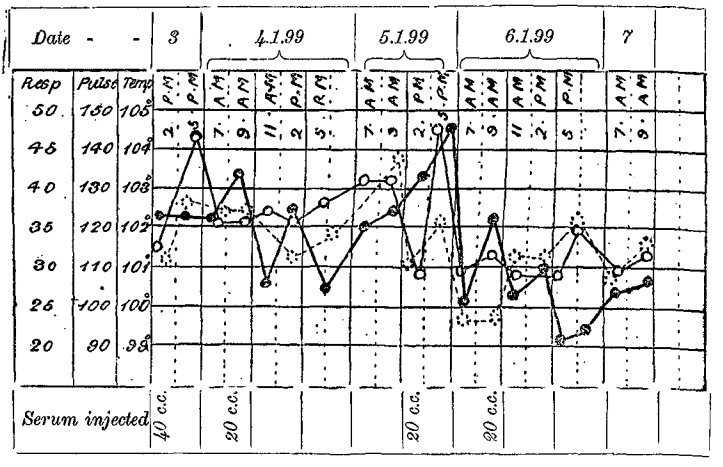
CASE No. XXXV. (Admitted on 3rd day of the disease.)

Ramalingam. Age 19. Admitted **2.1.99.**—10.30 a.m. Fever for two days. Bubo for one day. Temperature 104°. Pulse 120. Respiration 30. 3 p.m.—General condition fair. Tongue furred. Bubo in right groin. No wound found. Temperature 104·8°. Pulse 120. Respiration 32. 20 *c.c. inoculated.* 5 p.m.—Temp. 102°. Pulse 102. Respiration 36. **3.1.99.**—7 a.m.—Temp. 98°. Pulse 88. Respiration 22. 8.30 a.m.—Temp. 98·4°. Pulse 100. Respiration 22. Much better. Bubo in left axilla. 2 p.m.—Temp. 100°. Pulse 120. Respiration 36. 5 p.m.—Temp. 100°. Pulse 120. Respiration 30. **4.1.99.**—7 a.m.—Temp. 99·2°. Pulse 88. Respiration 34. 9 a.m.—Temp. 102°. Pulse 120. Respiration 28. Buboes very painful. 5 p.m.—Temp. 103°. Pulse 132. Respiration 42. **5.1.99.**—7 a.m.—Temp. 101°. Pulse 124. Respiration 35. 9 a.m.—Temp. 100·8°. Pulse 120. Respiration 30. **6.1.99.**—Removed to another ward to have the buboes opened.



2.1.99.—One case admitted with suppurating bubo in the morning and one in the afternoon.

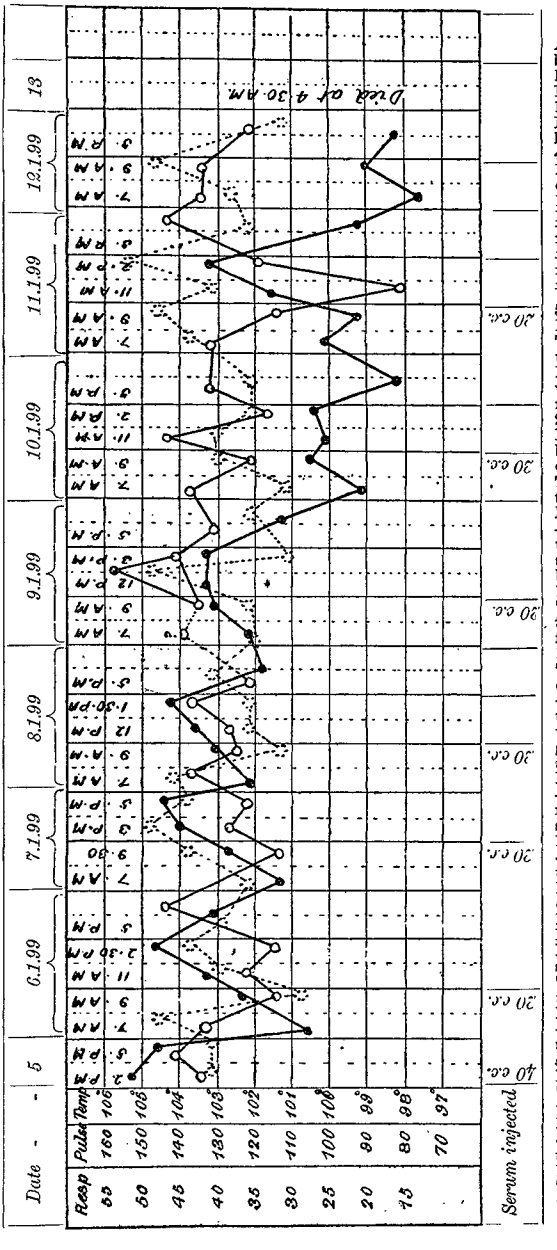
CASE No. XXXVI. (Admitted on 7th day of the disease.)



Mersamah. Age 25. Female. Admitted **3.1.99.**—2 p.m. Fever and bubo for six days. General condition fair; somewhat dull, and slightly delirious. Heart normal. Lungs: a few squeaks heard in both. Bubo in left groin. Temperature 102·2°. Pulse 114. Respiration 32. 40 *c.c. inoculated.* 5 p.m.—Temp. 102·2°. Pulse 144. Respiration 36. **4.1.99.**—7 a.m.—Temp. 102°. Pulse 120. Respiration 36. 9 a.m.—Temp. 103·4°. Pulse 120. Respiration 36. 20 *c.c. inoculated.* General condition a little worse, still slightly delirious. 11 a.m.—Temp. 100·6°. Pulse 124. Respiration 32. 2 p.m.—Temp. 102·6. Pulse 120. Respiration 40. Delirious. Bronchial breathing (modified) over the front of right lung, but resonance fair, although diminished. 5 p.m.—Temp. 100·6°. Pulse 126. Respiration 34. **5.1.99.**—7 a.m.—Temp. 102. Pulse 132. Respiration 40. 9 a.m.—Temp. 102·2°. Pulse 132. Respiration 44. 2 p.m.—Temp. 103·2°. Pulse 108. Respiration 32. 20 *c.c. serum.* 5 p.m.—Temp. 104·8. Pulse 144. Respiration 36. **6.1.99.**—7 a.m.—Temp. 100°. Pulse 108. Respiration 24. 9 a.m.—Temp. 102·2°. Pulse 112. Respiration 24. 20 *c.c. inoculated.* Lungs clear; breathing more natural. 11 a.m.—Temp. 100·2°. Pulse 108. Respirations 32. 2 p.m.—Temperature 101°. Pulse 108. Respiration 30. Complains of pain on swallowing. 5 p.m.—Temperature 99·2°. Pulse 120. Respiration 36. **7.1.99.**—7 a.m.—Temp. 100·4°. Pulse 108. Respiration 28. 9 a.m.—Temp. 100·6°. Pulse 112. Respiration 32.

5.1.99.—One case admitted suffering from a diffuse swelling of the whole thigh (left), removed to another hospital.

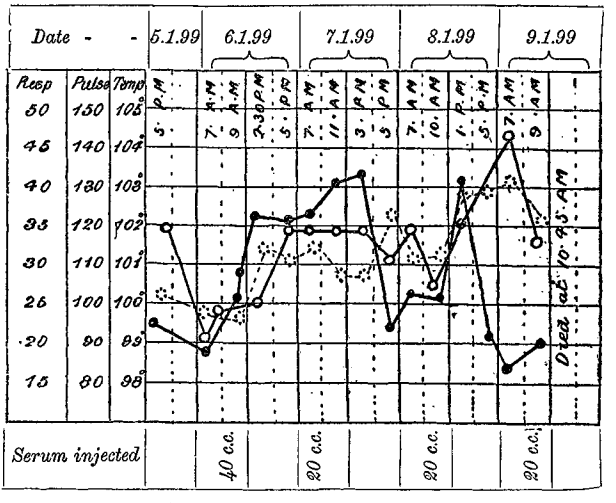
CASE No. XXXVII. (Admitted on 4th day of the disease.)



Mooniamah. Age 30. Female. Admitted **5.1.99.**—1 p.m. Fever and bubo for 3 days. 2 p.m.—Heart and lungs normal. General condition fair. Bubo in left groin. Temperature 105·2 . Pulse 132. Respiration 42. No wound, but states that she hurt her foot with a nail 3 or 4 days ago. 40 *c.c. inoculated.* 5 p.m.—Temp. 104·8°. Pulse 140. Respiration 40. **6.1.99.** 7 a.m.—Temp. 100·2°. Pulse 132. Respiration 48. 9 a.m.—Temp. 102·2°. Pulse 112. Respiration 28. Much better. 20 *c.c. inoculated.* 11 a.m.—Temp. 103·2°. Pulse 124. Respiration 40. 2.30 p.m.—Temp. 104·8°. Pulse 116. Respiration 44. Very delirious; condition worse. 5 p.m.—Temp. 103°. Pulse 144. Respiration 40. **7.1.99.**—7 a.m.—Temp. 101·2°. Pulse 122. Respiration 36. 9.30 a.m.—Temp. 102·8°. Pulse 112. Respiration 44. Pulse weak; very delirious during the night; now quiet, but very apathetic. 20 *c.c. serum.* 3 p.m.—Temp. 104°. Pulse 128. Respiration 48. Very bad. *Lungs: sibilant* râles heard over the front of both. 5 p.m.—Temp. 104·4°. Pulse 122. Respiration 44. **8.1.99.**—7 a.m.—Temp. 102°. Pulse 136. Respiration 45. 9 a.m.—Temp. 103°. Pulse 124. Respiration 32. 20 *c.c. serum.* Looks slightly better, but condition still bad. 12 p.m.—Temp. 103·6°. Pulse 126. Respiration 36. 1.30 p.m.—Temp. 104·2°. Pulse 136. Respiration 36. Condition very bad; pulse feeble. 5 p.m.—Temp. 101·8. Pulse 120. Respiration 42. **9.1.99.**—7 a.m.—Temp. 102°. Pulse (was uncountable). Respiration 35. 9 a.m.—Temp. 103°. Pulse 132. Respiration 36. Patient very wasted; pulse very bad. **9.1.99.**—Seems to be getting worse day by day. 20 *c.c. inoculated.* 12 p.m.—Temp. 103·2°. Pulse 156. Respiration 48. 3 p.m.—Temp. 103·2°. Pulse 140. Respiration 30. Very bad; pulse very small. 5 p.m.—Temp. 101·6°. Pulse 130. Respiration 36. **10.1.99.**—7 a.m.—Temp. 99°. Pulse 136. Respiration 30. 9 a.m.—Temp. 100·6°. Pulse 120. Respiration 40. Still exceeding weak. 20 *c.c. serum.* 11 a.m.—Temp. 100°. Pulse 144. Respiration 40. 2 p.m.—Temp. 100·2°. Pulse 116. Respiration 36. Pulse stronger; slightly better. 5 p.m.—Temp. 98·2°. Pulse 132. Respiration 36. **11.1.99.**—7 a.m.—Temp. 100°. Pulse 132. Respiration 44. 9 a.m.—Temp. 99·4°. Pulse 116. Respiration 48. Lungs: many râles. 20 *c.c. serum.* 11 a.m.—Temp. 101·6°. Pulse 80. Respiration 40. 2 p.m.—Temp. 103·2. Pulse 120. Respiration 52. 5 p.m.—Temp. 99·2°. Pulse 144. Respiration 36. **12.1.99.**—7 a.m.—Temp. 97·6°. Pulse 132. Respiration 38. 9 a.m.—Temp. 99°. Pulse 132. Respiration 48. 5 p.m.—Temp. 98·2°. Pulse 120. Respiration 32.

5.1.99.—One case admitted with normal temperature, who was found in a street seeming insensible, he had, however, drunk an unknown quantity of alcohol.

CASE NO. XXXVIII. (Admitted on 1st day of the disease.)

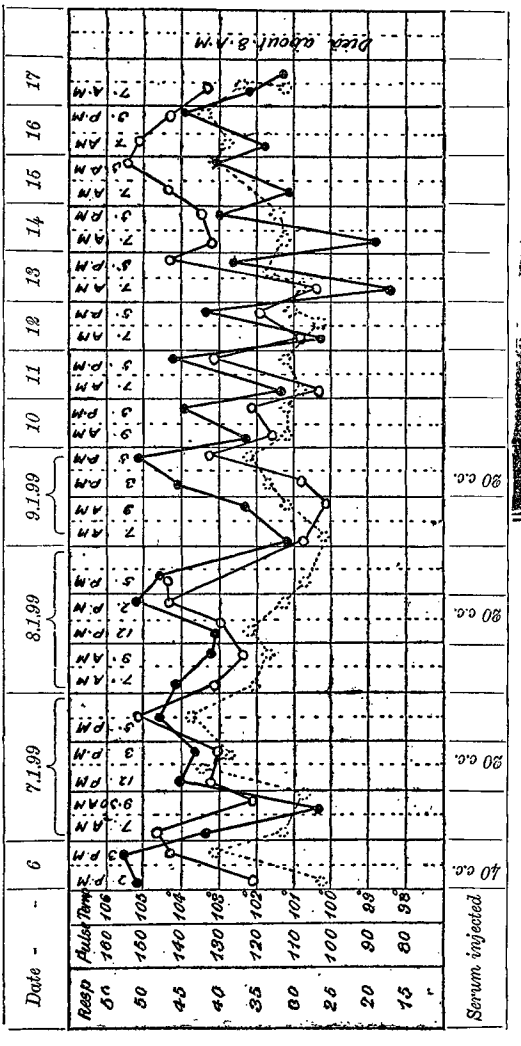


Anthony. Age 60. Male. Admitted **5.1.99.**—4 p.m. Taken ill yesterday (day of admission). Pain in the groin came on last night (5 and 6). Temp. 99·4°. Pulse 120. Respiration 26. **6.1.99.**—7 a.m.—Temp. 98·8°. Pulse 90. Respiration 24. 9 a.m.—Temp. 100·8°. Pulse 96. Respiration 24. A small painful bubo in left groin. Heart and lungs clear. Tongue very foul fur. General condition good. 40 *c.c. inoculated.* 2.20 p.m. —Temp. 102·6°. Pulse 100. Respiration 32. Some headache. 5 p.m.—Temp. 102·2°. Pulse 120. Respiration 30. **7.1.99.**—7 a.m.—Temp. 102·2°. Pulse 120. Respiration 32. 9 a.m.—20 *c.c. inoculated.* 11 a.m.—Temp. 103°. Pulse 120. Respiration 28. 3 p.m.—Temp. 103·2°. Pulse 120. Respiration 28. General condition fair. 5 p.m.—Temp. 99·4°. Pulse 110. Respiration 36. **8.1.99.**—7 a.m.—Temp. 100·4°. Pulse 120. Respiration 30. 10 a.m.—Temp. 100·2°. Pulse 104. Respiration 34. 1 p.m.—Temp. 103·2°. Pulse 120. Respiration 38. 20 *c.c. serum.* 5 p.m.—Temp. 99·2°. Pulse 128. Respiration 40. **9.1.99.**—7 a.m.—Temp. 98·4°. Pulse 144. Respiration 42. 9 a.m.—Condition very bad, extremely weak, pulse very small. Temp. 99°. Pulse 116. Respiration 36. 20 *c.c. serum.*

6.1.99.—One case of tetanus admitted, but transferred to another hospital.

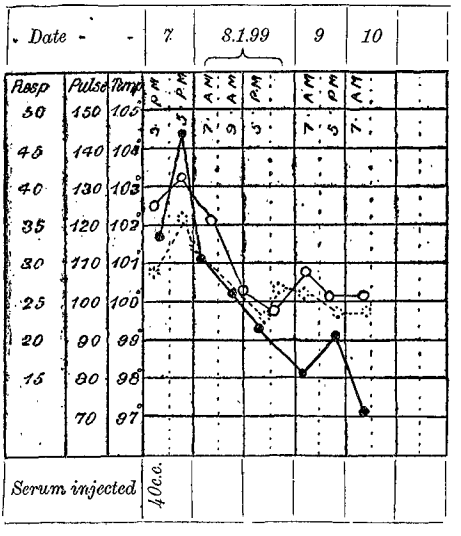
CASE No. XXXIX. (Admitted on 6th day of the disease.)

Soomana. Aged 15. Female. Admitted **6.1.99.**—1 p.m. Pain in the neck for five days. Fever came on last night. 2 p.m. — General condition fair. Temp. 105°. Pulse 120. Respiration 26. Heart and lungs normal. Bubo on right side of neck, on the skin covering the bubo are four vesicles somewhat like 4th day vaccinia vesicles. Tongue furred white. Fauces reddened. 40 *c.c. serum.* 5 p.m.—Temp. 105·2°. Pulse 144. Respiration 40. **7.1.99.**—7 a.m.—Temp. 103.4°. Pulse 148. Respiration 32. 9.30. a.m. —Temp. 100·6°. Pulse 120. Respiration 28. Much better. 12 p.m.—Temp. 104°. Pulse 132. Respiration 42. 3 p.m.—Temp. 103·8°. Pulse 120. Respiration 38. 20 *c.c. inoculated.* 5 p.m. —Temp. 104·4°. Pulse 150. Respiration 44. **8.1.99.**—7 a.m.—Temp. 104°. Pulse 130. Respiration 35. 9 a.m.—Temp. 103·2°. Pulse 124. Respiration 34. 12 p.m.—Temp. 103°. Pulse 130. Respiration 36. 2 p.m.—Temp. 105·2°. Pulse 144. Respiration 32. 20 *c.c. serum.* 5 p.m.—Temp. 104·6°. Pulse 144. Respiration 28. **9.1.99.**—7 a.m.—Temp 101°. Pulse 108. Respiration 26. 9 a.m. — Temp. 102·2°. Pulse 100. Respiration 32. General condition better. Bubo extends from the middle line of the neck and fills up the whole of the submaxillary region. 3 p.m.—Temp. 104°. Pulse 108. Respiration 34. 20 *c.c. serum.* 5 p.m.—Temp. 105·2°. Pulse 132. Respiration 36. **10.1.99.**—9 a.m.—Temp. 102·2°. Pulse 116. Respiration 32. Bubo softening and showing signs of suppuration. Removed to another ward to have it opened. Bubo opened freely but no pus let out. 5 p.m.—Temp. 104°. Pulse 122. Respiration 32. **11.1.99.**—7 a.m. —Temp. 101·4°. Pulse 104. Respiration 28. 5 p.m.—Temp. 104·2°. Pulse 132. Respiration 32. **12.1.99.**—7 a.m. Temp. 100·2°. Pulse 108. Respiration 26. 5 p.m.—Temp. 103·4°. Pulse 120. Respiration 32. **13.1.99.**—7 a.m.—Temp. 98·4°. Pulse 104. Respiration 28. 5 p.m.—Temp. 102·8°. Pulse 144. Respiration 34. **14.1.99.**—7 a.m.—Temp. 98·8°. Pulse 132. Respiration 32. 5 p.m.—Temp. 103°. Pulse 134. Respiration 34. **15.1.99.**—7 a.m.—Temp. 101°. Pulse 144. Respiration 36. 5 p.m.—Temp. 103°. Pulse 156. Respiration 40. **16.1.99.**—7 a.m.—Temp. 101·8°. Pulse 152. Respiration 38. 5 p.m.—Temp. 104°.—Pulse 144. Respiration 42. **17.1.99.**—7 a.m.—Temp. 101·6°. Pulse 132. Respiration 36. On **16.1.99.** patient suddenly became much worse the breathing becoming laboured, signs of pneumonia rapidly developed, and she died on the morning of **17.1.99.**



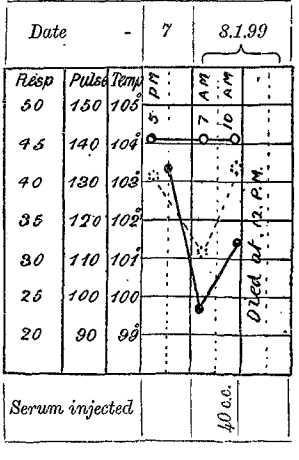
7.1.99.—One case admitted, ? acute rheumatism.

CASE No. XL. (Admitted on 4th day of the disease.)



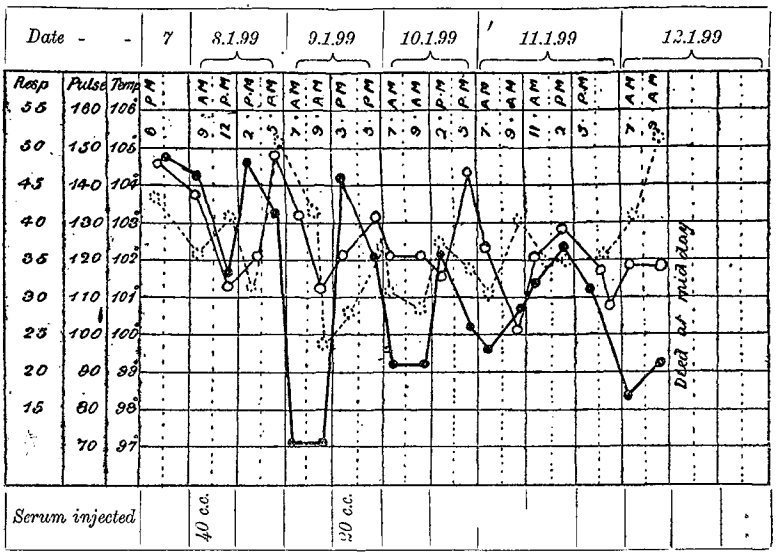
Venketamah. Age 20. Female. Admitted **7.1.99.**—11.30 a.m. Three days fever, two days bubo. 3.0 p.m.—General condition fair. Heart and lungs clear. Bubo in left axilla. Temperature 101·6°. Pulse 124. Respiration 28. 40 *c.c. inoculated.* 5.0 p.m.—Temp. 104·4°. Pulse 132. Respiration 36. **8.1.99.**—7.0 a.m.—Temp. 101°. Pulse 120. Respiration 32. 9.0 a.m.—Temp. 100·2°. Pulse 100. Respiration 28. Very much better. 5.0 p.m.—Temp. 99·2°. Pulse 98. Respiration 24. **9.1.99.**—7.0 a.m.—Temp. 98°. Pulse 108. Respiration 26. Feels quite well. 5.0 p.m.—Temp. 99·2°. Pulse 98. Respiration 24. **10.1.99.**—7.0 a.m.—Temp. 97°. Pulse 98. Respiration 24.

CASE No. XLI. (Admitted on 4th day of the disease.)



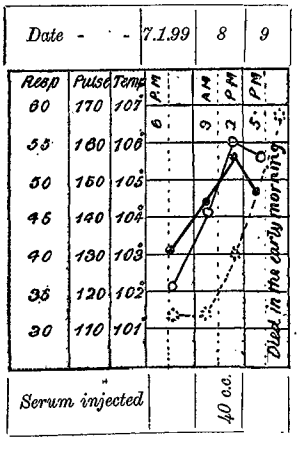
Annamaly. Age 50. Male, Admitted **7.1.99.**—5.0 p.m. Fever for three or four days. Temp. 103·4°. Pulse 140. Respiration 40. **8.1.99.**—7.0 a.m.—Temp. 99·8°. Pulse 140. Respiration 30. 10.0 a.m.—Very delirious. General condition very bad, moribund. Bubo in Pulse very bad, 140. Respiration laboured, 44. Resonance over both lungs poor. Prolonged expiration heard over both lungs. Temp. 101·4°. *40 c.c. inoculated.*

CASE No. XLII. (Admitted on 5th day of the disease.)



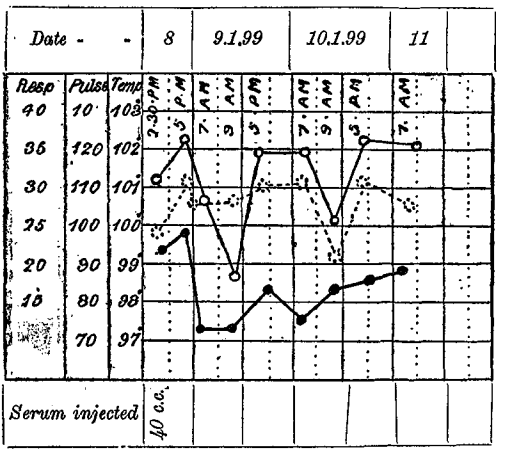
Pragasum. Age 35. Female. Admitted **7.1.99.**—6 p.m. Fever and bubo, four days. Temperature 104·8°. Pulse 148. Respiration 44. **8.1.99.**—9 a.m.—General condition indifferent. Heart and lungs normal. Bubo in right groin. Pregnant six months. Temp. 104·2°. Pulse 138. Respiration 36. 40 *c.c. serum.* 12 p.m.—Temp. 101·6°. Pulse 112. Respiration 42. 2 p.m.—Temp. 104·6°. Pulse 120. Respiration 32. 5 p.m.—Temp. 103·4°. Pulse 146. Respiration 50. **9.1.99.**—7 a.m.—Temp. 97°. Pulse 132. Respiration 42. 9 a.m.—Temp. 97. Pulse 112. Respiration 24. 3 p.m.—Temp. 104·2°. Pulse 120. Respiration 28. 20 *c.c. serum,* 5 p.m.—Temp. 102°. Pulse 132. Respiration 36. **10.1.99.**—7 a.m.—Temp. 99·2°. Pulse 120. Respiration 30. 9 a.m.—Temp. 99·2°. Pulse 120. Respiration 28. Aborted last night. Complains of much pain in the bubo. 2 p.m.—Temp. 102·2°. Pulse 116. Respiration 36. 5 p.m.—Temp. 100·4°. Pulse 144. Respiration 34. **11.1.99.**—7 a.m.—Temp. 99·8°. Pulse 122. Respiration 30. 9 a.m.—Temp. 100·6°. Pulse 100. Respiration 40. 11 a.m.—Temp. 101·2°. Pulse 120. Respiration 34. 2 p.m.—Temp. 102·4°. Pulse 128. Respiration 36. Condition not so good. 5 p.m.—Temp. 100·2°. Pulse 108. Respiration 36. **12.1.99.**—7 a.m.—Temp. 98·4°. Pulse 120. Respiration 42. 9 a.m.—Temp. 99·4°. Pulse 120. Respiration 52. Condition bad, breathing very rapid, laboured; nothing discovered in lungs.

CASE No. XLIII. (Admitted on 2nd day of the disease.)



Arokin. Age 20. Female. Admitted **7.1.99.**—6 p.m. Taken ill yesterday. No bubo noticed. Temperature 103°. Pulse 120. Respiration 32. **8.1.99.**—9 a.m.—General condition indifferent. Heart and lungs normal. Tongue furred white, papillae very prominent. No spleen could be felt. Temp. 104·6°. Pulse 140. Respiration 32. 2.30 p.m.—Temp. 105·6°. Pulse 160. Respiration 40. General condition worse. Pulse small. Tenderness and slight enlargement of right cervical glands. 40 *c.c. of serum.* 5 p.m.—Temp. 104·8°. Pulse 156. Respiration 58.

CASE No. XLIV. (Admitted on 3rd day of the disease.)



Sodambah. Age . Female. Admitted **8.1.99.**—10.30 a.m. Fever and bubo for three days. 2.30 p.m.—Temperature 99·4°. Pulse 112. Respiration 24. General condition good. Bubo in right axilla. Heart and lungs normal. 40 *c.c. of serum.* 5 p.m. —Temp. 99·8°. Pulse 122. Respiration 32. **9.1.99**—7 a.m.—Temp. 97·4°. Pulse 108. Respiration 28. 9 a.m.—Temp. 97·4°. Pulse 88. Respiration 28. Feels quite well. 5 p.m.—Temp. 98·4°. Pulse 120. Respiration 30. **10.1.99.**—7 a.m.—Temp. 97·6°. Pulse 120. Respiration 30. 9 a.m.—Temp. 98·4°. Pulse 100. Respiration 20. 5 p.m. —Temp. 98·6°. Pulse 124. Respiration 32. **11.1.99.**—7 a.m.—Temp. 98·8. Pulse 120. Respiration 28.

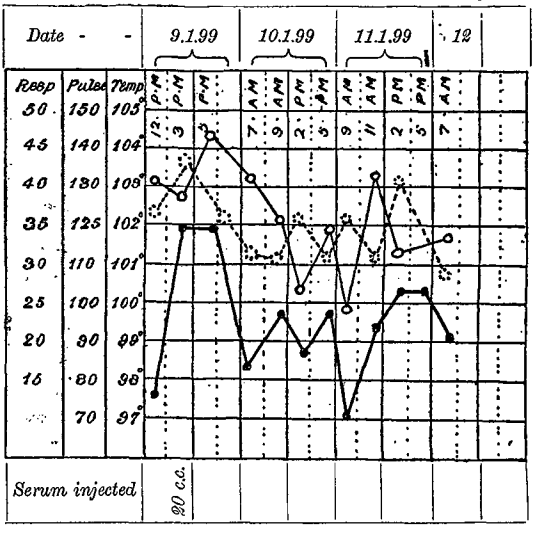
CASES OF PLAGUE

TREATED WITH

SERUM ANTI-PESTEUX FROM PASTEUR INSTITUTE. (HORSE No. 31.)

9.1.99.—One child, about three, admitted whose temperature fell to normal soon after admission, and who was, therefore, not inoculated.
One woman admitted who died almost directly after admission, and was not seen by me.

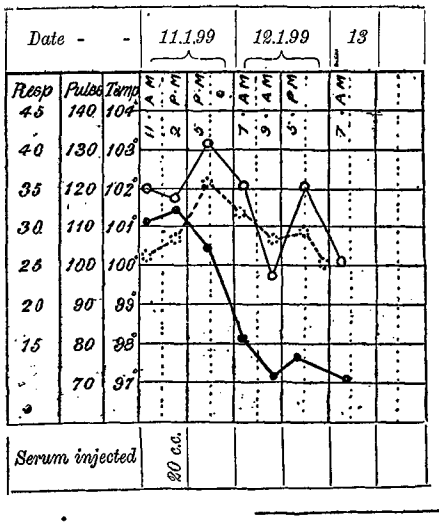
CASE No. I. A. (Admitted on 3rd day of the disease.)



Venkoba. Age 3. Male. Admitted **9.1.99.**—12.0 p.m. Fever for two days. Temp. 97·8°. Pulse 132. Respiration 36. 3.0 p.m.—General condition indifferent. Dull and apathetic. Bubo in right axilla. Temp. 102°. Pulse 128. Respiration 44. Heart and lungs clear (double cataract). 20 *c.c. serum inoculated.* 5.0 p.m.—Temp. 102°. Pulse 144. Respiration 36. **10.1.99.**—7.0 a.m.—Temp. 98·4°. Pulse 132. Respiration 32. 9.0 a.m.—Temp. 99·6°. Pulse 120. Respiration 30. Sleepy, but much better. 2.0 p.m.—Temp. 98·8°. Pulse 104. Respiration 36. Condition much improved. 5.0 p.m. Temp. 99·6°. Pulse 120. Respiration 30. **11.1.99.**—9.0 a.m.—Temp. 97.° Pulse 98. Respiration 36. 11.0 a.m.—Temp. 99·2°. Pulse 132. Respiration 30. 2.0 p.m.—Temp. 100·4°. Pulse 112. Respiration 40. Condition good. 5.0 p.m.—Temp. 100·4°. **12.1.99.**—7.0 a.m.—Temp. 99°. Pulse 116. Respiration 28. Bubo suppurated.

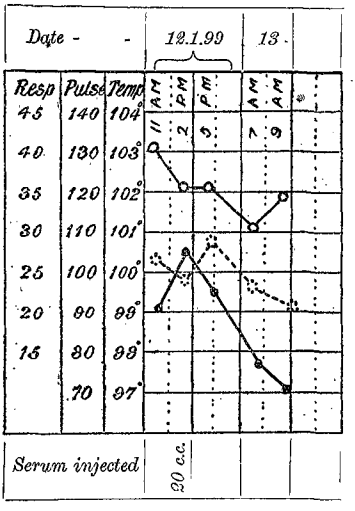
11.1.99.—Two cases admitted, but died before they were seen.

CASE No. II. A. (Admitted on 5th day of the disease.)



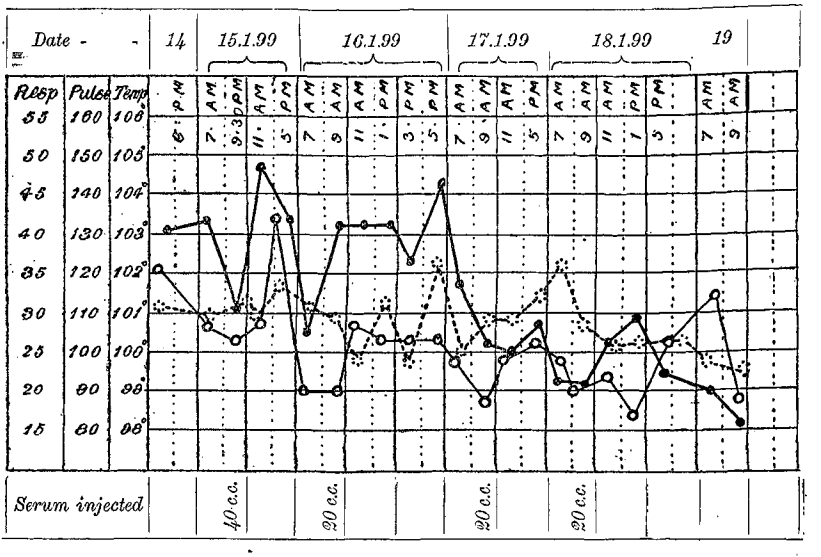
Thalaro. Age 13. Female. Admitted **11.1.99.**—11.0 a.m.—Pain in the neck for six days. Fever for four days. Temp. 101°. Pulse 120. Respiration 26. 2.0 p.m.—Temp. 101·4°. Pulse 116. Respiration 28. 20 *c.c. serum.* Very small swelling on left side of neck. 5.0 p.m.—Temp. 100·4°. Pulse 132. Respiration 36. **12.1.99.**—7.0 a.m.—Temp. 98°. Pulse 120. Respiration 32. 9.0 a.m.—Temp. 97·2°. Pulse 96. Respiration 28. Practically well. 5.0 p.m.—Temp. 97·8°. Pulse 120. Respiration 30. **13.1.99.**—7.0 a.m.—Temp. 97°. Pulse 100. Respiration 26.

CASE No. III. A. (Admitted on 4th day of the disease.)



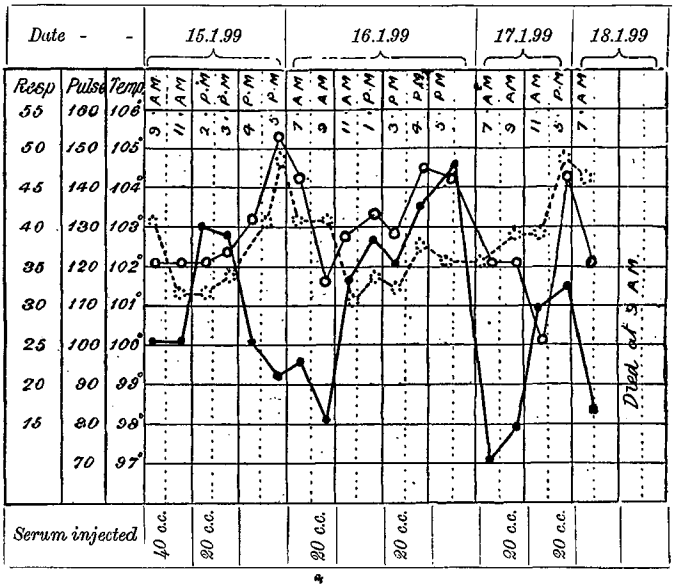
Mary. Age 2½. Female. Admitted **12.1.99.**—11 a.m. Bubo and fever three days. Temperature 99°. Pulse 130. Respiration 26. 2 p.m.—General condition good. Bubo in left groin. Heart and lungs normal. Temperature 100·6°. Pulse 120. Respiration 24. 20 *c.c. serum.* 5 p.m.—Temp. 99·6°. Pulse 120. Respiration 28. **13.1.99.**—7 a.m.—Temp. 97·8. Pulse 110. Respiration 24. 9 a.m.—Temp. 97°. Pulse 120. Respiration 20. Practically well.

CASE No. IV. A. (Admitted on 4th day of the disease.)



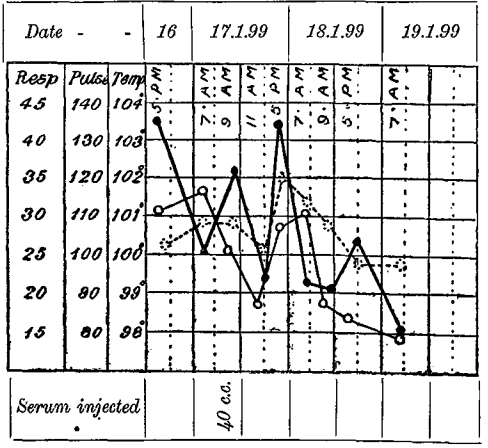
Pir. Khan. Age 35. Male. Admitted **14.1.99.**—6 p.m.—Bubo and fever for three days. Temperature 103°. Pulse 120. Respiration 30. **15.1.99.**—7 a.m.—Temp. 103·4°. Pulse 108. Respiration 28. 9.30 a.m.—Temp. 101°. Pulse 104. Respiration 32. General condition fair. Bubo in left groin. Heart and lungs natural. 40 *c.c. serum.* 11 a.m.—Temp. 104·8°. Pulse 108. Respiration 30. 5 p.m.—Temp. 103·4°. Pulse 136. Respiration 34. **16.1.99.**—7 a.m.—Temp. 100·4°. Pulse 90. Respiration 28. 9 a.m.—Temp. 103·2°. Pulse 90. Respiration 30. Pulse good. Sensible. 20 *c.c. serum.* 11 a.m.—Temp. 103·2°. Pulse 108. Respiration 24. 1 p.m.—Temp. 103·2°. Pulse 104. Respiration 32. Complains of pain in left epitrochlear region. 3 p.m.—Temp. 102·4°. Pulse 104. Respiration 24. 5 p.m.—Temp. 104·4°. Pulse 104. Respiration 36. **17.1.99.**—7 a.m.—Temp. 101·8°. Pulse 98. Respiration 24. 9 a.m.—Temp. 100·4°. Pulse 88. Respiration 28. 20 *c.c. serum.* Slightly delirious. 11 a.m.—Temp. 100. Pulse 100. Respiration 28. 5 p.m.—Temp. 100·8°. Pulse 104. Respiration 32. **18.1.99.**—7 a.m.—Temp. 99·4°. Pulse 98. Respiration 36. 9 a.m.—Temp. 99·2°. Pulse 92. Respiration 28. Talkative; rather incoherent. 20 *c.c. serum.* 11 a.m.—Temp. 100·4°. Pulse 96. Respiration 26. 1 p.m.—Temp. 101°. Pulse 84. Respiration 26. 5 p.m.—Temp. 99·6°. Pulse 104. Respiration 26. **19.1.99.**—7 a.m.—Temp. 99°. Pulse 116. Respiration 24. 9. a.m.—Temp. 98·4°. Pulse 84. Respiration 22. Much better. Tongue cleaning. Bubo painful. Epitrochlear tenderness disappeared. Bubo in left groin looked as if would suppurate.

CASE No. V. A. (Admitted on 4th day of the disease.)



Muragasum. Age 21. Male. Admitted **15.1.99.**—9 a.m. Ill for three or four days. General condition very bad Delirious, very restless, constantly picking at the bed-clothes. Eyes very injected. Temperature 100°. Pulse 120. Respiration 40. Bubo on left side of neck. 40 *c.c. serum.* 11 a.m.—Temp. 100°. Pulse 120. Respiration 32. 2 p.m.—Temp. 103°. Pulse 120. Respiration 32. 20 *c.c. serum* intravenous. 3 p.m.—Temp. 102·8°. Pulse 124. Respiration 34. 4 p.m.—Temp. 100°. Pulse 132. Respiration 40. 5 p.m.—Temp. 99·4°. Pulse 156. Respiration 48. **16.1.99.**—7 a.m.—Temp. 99·8°. Pulse 144. Respiration 40. 9 a.m.—Temp. 98°. Pulse 108. Respiration 40. General condition unchanged, still the same delirium, never still, always talking. 20 *c.c. serum* sub-cute. 11 a.m.—Temp. 101·8°. Pulse 128. Respiration 30. 1 p.m.—Temp. 102·6°. Pulse 132. Respiration 34. 3 p.m.—Temp. 102°. Pulse 128. Respiration 32. 20 *c.c. serum* intravenous. 4 p.m.—Temp. 103·4°. Pulse 144. Respiration 38. 5 p.m.—Temp. 104·4°. Pulse 144 Respiration 36. **17.1.99.**—7 a.m.—Temp. 97°. Pulse 120. Respiration 36. 9 a.m.—Temp. 98°. Pulse 120. Respiration 40. General condition, no better. 20 *c.c. serum.* 11 a.m.—Temp. 101°. Pulse 100. Respiration 40. 2 p.m.—Quieter evidently from exhaustion. Muttering. 20 *c.c.* sub-cute. Cultivation from blood made. No plague bacilli. 5 p.m.—Temp. 101·4°. Pulse 144. Respiration 48. **18.1.99.**—7 a.m.—Temp. 98·4°. Pulse 120. Respiration 46.

CASE No. VI. A. (Admitted on 5th day of the disease.)



Mooniappab. Age 50. Male. Admitted **16.1.99.**—5 p.m. Ill four days. Bubo four days. 5 p.m.—Temperature 103·6°. Pulse 110. Respiration 26. **17.1.99.**—7 a.m.—Temp. 100°. Pulse 118. Respiration 28. 9 a.m.—Temp. 102·2°. Pulse 100. Respiration 28. General condition good. Heart and lungs normal. Bubo in left groin. 40 *c.c. serum.* 11 a.m.—Temp. 99·4°. Pulse 88. Respiration 24. 5 p.m.—Temp. 103·4. Pulse 108. Respiration 36. **18.1.99.**—7 a.m.—Temp. 99·4°. Pulse 110. Respiration 30. 9 a.m.—Temp. 99°. Pulse 88. Respiration 28. Much better. 5 p.m.—Temp. 100·4°. Pulse 84. Respiration 24. **19.1.99.**—7 a.m.—Temp. 98°. Pulse 80. Respiration 24.

ABSTRACT OF STATISTICS AT BANGALORE.

Cases admitted into South Camp Hospital before December 25th, 686.
Deaths, 403.
Percentage of deaths, 58·7.

Total cases admitted from 25.12.98 to 12.1.99, 73.
Deaths, 35.
Percentage of deaths, 47·9.

Total bubonic cases during same period, 39.
Deaths, 20.
Percentage, 51·3.

Total non-bubonic cases during same period, 34.
Deaths, 15.
Percentage of deaths, 44·1.

Total cases treated with Roux serum from 25.12.98 to 16.1.99, 49.
Deaths, 31.
Percentage, 63·26.

Total cases admitted into North Camp from September 15th to November 19th, 365.
Deaths, 275.
Percentage of deaths, 75·13.

Total cases from December 25th to January 12th, 54 cases.
Total deaths, 29.
Percentage of deaths, 53·7.

Total bubonic cases, 14.
Deaths among bubonic cases, 10.
Percentage, 71·42.

S. R. Douglas, Lt., I.M.S.

APPENDIX No. LXXX.

NOTES

OF

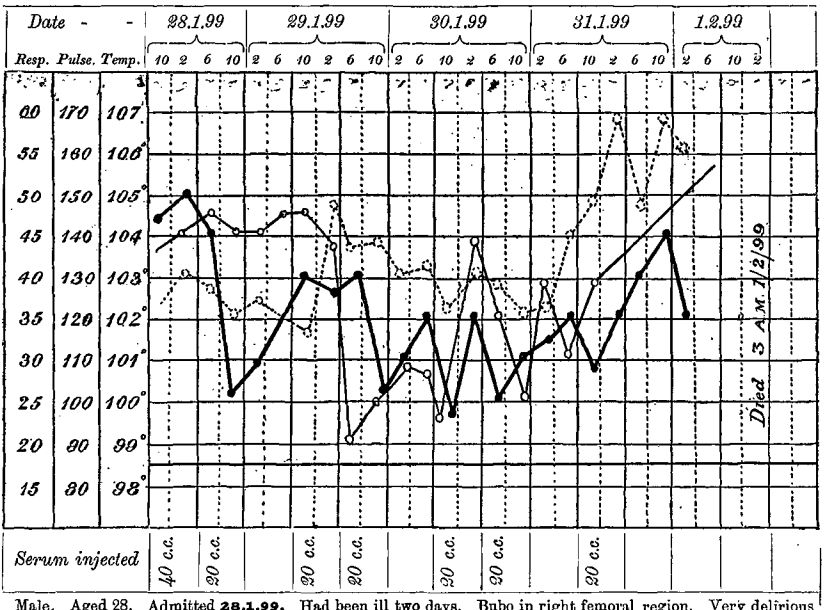
CASES TREATED WITH ROUX' SERUM AT MODI KHANA HOSPITAL, BOMBAY, WITH AN EQUAL NUMBER OF CONTROLS,

BY

LIEUT. S. R. DOUGLAS, I.M.S.
On Special Duty with the Indian Plague Commission.

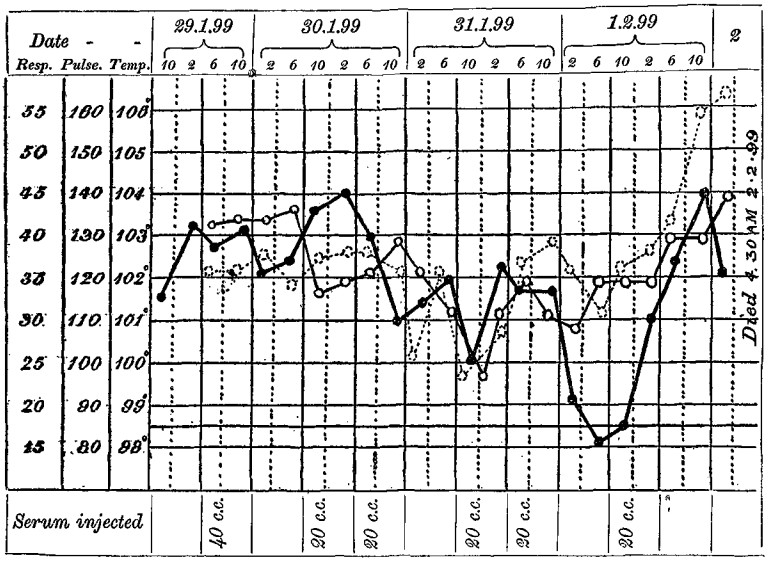
NOTE.—The numbers in brackets are the numbers of the cases in the Register at the Modi Khana Hospital. Observations in cases treated with Roux' serum are made every 4 hours, at 2, 6, and 10 a.m., and at 2, 6, and 10 p.m. The thick black line indicates the temperature, the thin black line the pulse, and the dotted line the respiration.

CASE No. I. (No. 1654.)



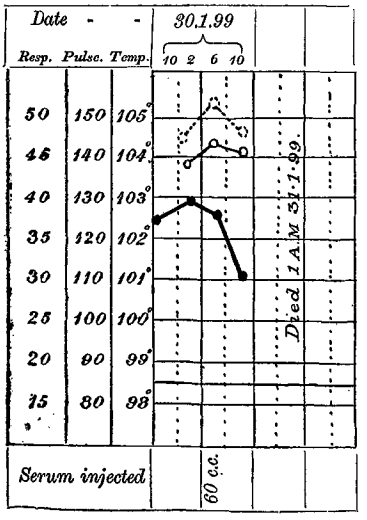
Male. Aged 28. Admitted **28.1.99.** Had been ill two days. Bubo in right femoral region. Very delirious Much bruised about the face. Heart and lungs, no abnormalities found. Retention of urine. Speech mumbling indistinct. **29.1.99.**—Slightly better apparently, still delirious. Bubo has more infiltration round it. **30.1.99** —Has developed a corneal ulcer. **31.1.99.**—Quiet, seemingly exhausted. Bubo softer and has extended upwards.

CASE No. II. (No. 1669.)



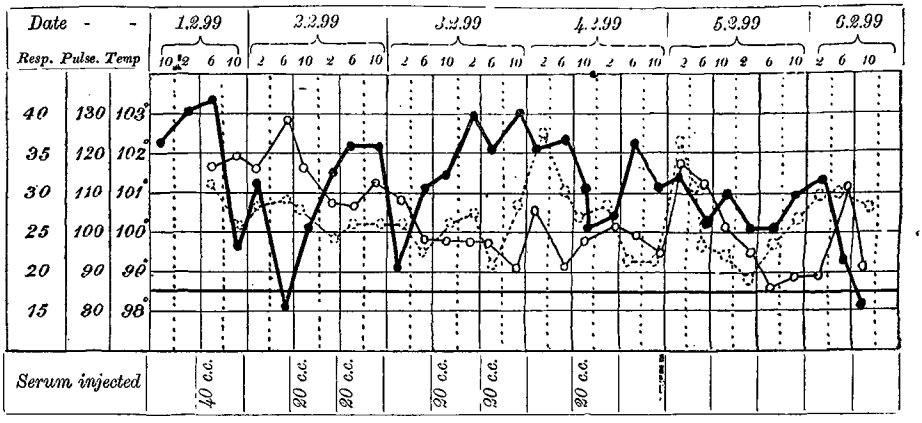
Male. Aged 35. Ill three days before. Bubo in left groin. Patient is conscious. Heart and lungs, nothing abnormal found. **30.1.99.**—Rather delirious. Speech very indistinct. **31.1.99.**—Slept well, not so delirious. **1.2.99.**—Worse, very delirious.

CASE No. III. (No. 1680.)



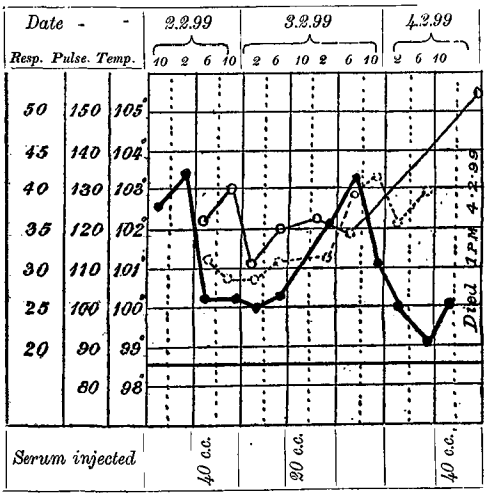
Male. Age 28. Admitted **30.1.99.** Ill for two days. Bubo in left groin. Unconscious. Quiet, but rather restless. Blood drawn off. (Culture made; many colonies of bacilli.)

CASE No. IV. (No. 1700.)



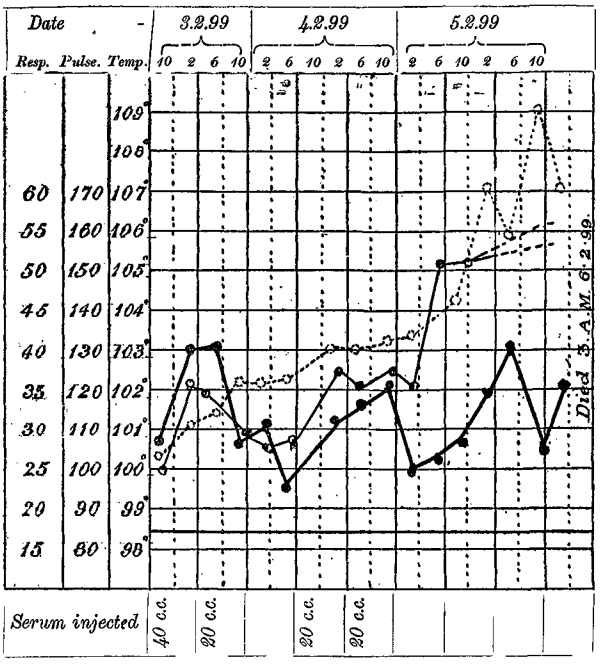
Male. Age 30. Admitted **1.2.99.** Ill for two days. Bubo in left groin. Has cough; râles in rhonchi in right lung. **2.2.99.**—Slept well. Pulse good. **3.2.99.**—Gland less painful. Pulse fair. **4.2.99.**—Eyes rather injected. Pulse good. **5.2.99.**—No serum given. Patient improving. Very weak. **6.2.99.**—Bubo incised. No pus, but some necrosed gland removed. **17.3.99.**—Patient discharged.

CASE No. V. (No. 1712.)



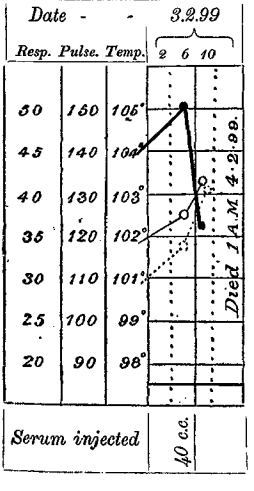
Male. Age 40. Admitted **2.2.99.** Ill for two days. Bubo in left inguinal region. Speech indistinct. Prolonged expiration and rhonchi over both lungs. **3.2.99.**—No sleep. Gurgling respiration. Eyes injected. **4.2.99.**—Limbs cold. Pulse running.

CASE No. VI. (No. 1722.)



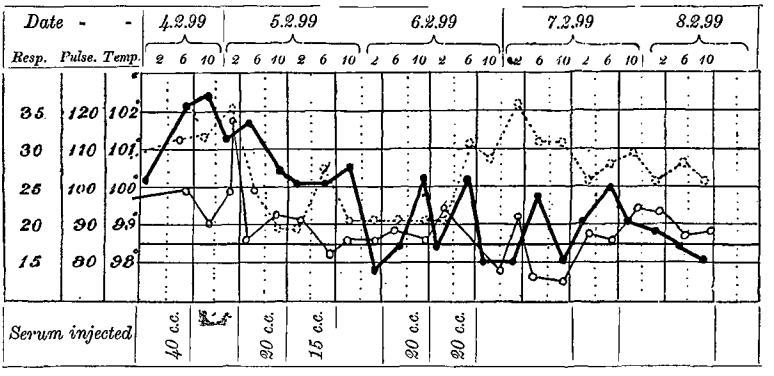
Male. Age 30. Admitted **3.2.99.** Ill for three days. Bubo in right submaxillary region. Very large. Eyes injected. Has difficulty in swallowing. **4.2.99.**—Muttering delirium. No sleep. Swelling round bubo has increased. **5.2.99.** — Respiration very rapid. Pulse running.

CASE No. VII. (No. 1730.)



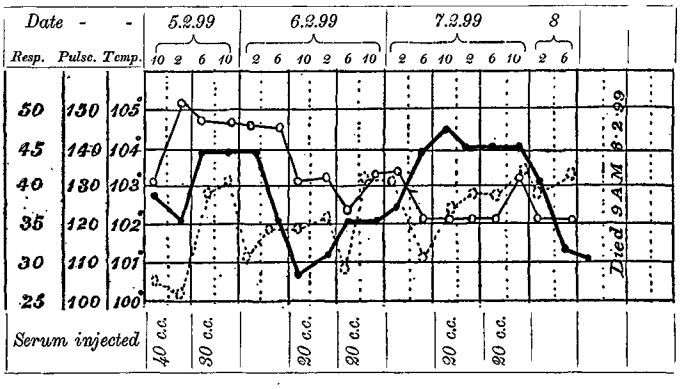
Male. Age 30. Admitted **3.2.99.** Ill for four days. Bubo in left femoral region. Lungs not affected. Speech very indistinct. Limbs cold.

CASE No. VIII. (No. 1743.)



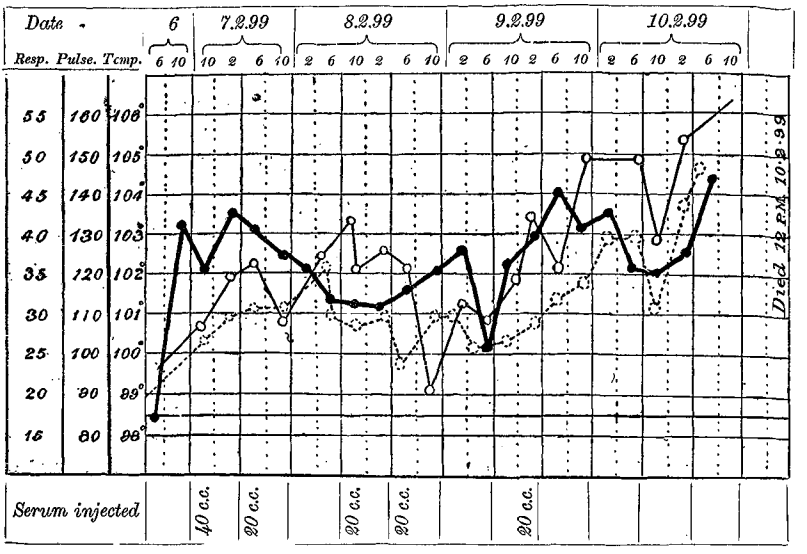
Male. Aged 25. Admitted **4.2.99.** Ill for four days. Bubo in right groin. Rhonchi heard at the base of the right lung. Speech indistinct. **5.2.99.**—Condition unchanged. Slept well. 6.2.99.—Gland still hard, slight improvement. **7.2.99.**—Serum discontinued. improvement continues. 10.2.99.—Bubo incised, some pus and broken down gland escaping. **15.3.99.**—Discharged.

CASE No. IX. (No. 1747.)



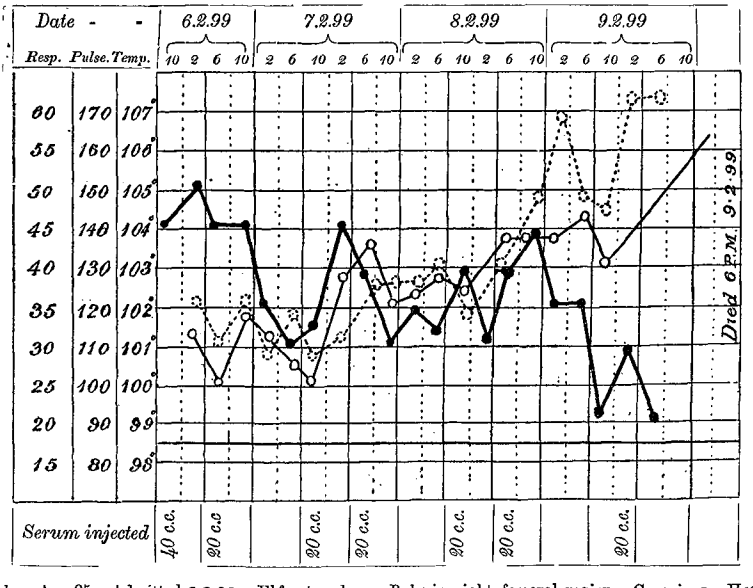
Male. Aged 24. Admitted **5.2.99.** Ill for four days. Bubo in right axilla. Patient is conscious. Heart and lungs clear. **7.2.99.**—Quiet all night. Eyes very injected. **8.2.99**—Respiration shallow. Extremities cold.

CASE No. X. (No. 1763.)



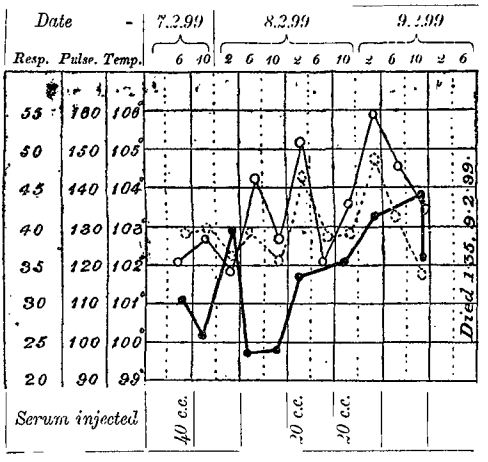
Male. Age 40. Admitted **6.2.99.** Ill for three days. Bubo in left axilla. **7.2.99.**—Râles and rhonchi heard over both lungs. Is very delirious. **8.2.99.**—Very delirious. Pulse very bad. **9.2.99.**—Condition unchanged. **10.2.99.**—Speech very indistinct. Pulse running. Extremities cold.

CASE No. XI. (No. 1766.)



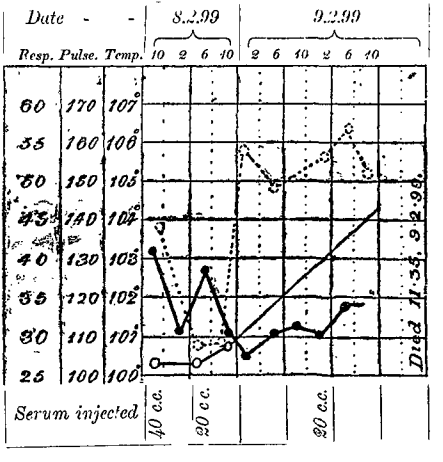
Male. Age 25. Admitted **6.2.99.** Ill for two days. Bubo in right femoral region. Conscious. Heart and lungs unaffected. **7.2.99.**—Slept well. Has retention of urine. **8.2.99.**—Has another gland in left groin, retention of urine continues. **9.2.99.**—Violently delirious. Respiration very rapid. Pulse running.

CASE No. XII. (No. 1783.)



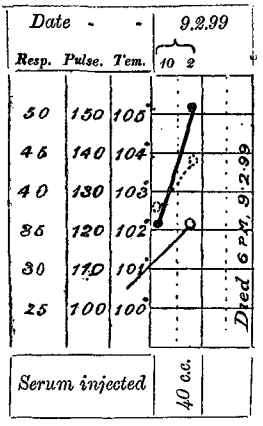
Male. Age 24. Admitted **7.2.99.** Ill for two days. Bubo in left axilla. Conscious. Sibilant rhonchi over both lungs. **8.2.99.**—Quiet, but general condition worse. Pulse rapid. **9.2.99.**—Very delirious.

CASE No. XIII. (No. 1788.)



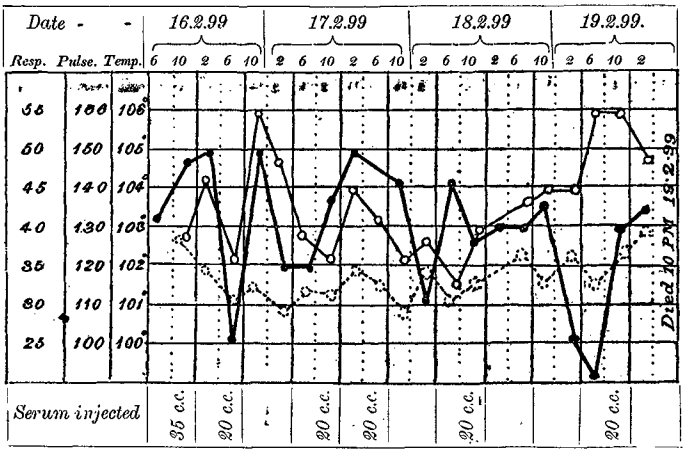
Male. Age 30. Admitted **8.2.99.** Ill for two days. Bubo in right groin. Lungs not affected. **9.2.99.**—Breathing has become very rapid. Pulse running.

CASE No. XIV. (No. 1805.)



Male. Aged 25. Admitted **9.2.99.** Ill for three days. Bubo in right groin. Bronchial breathing heard over the whole of the left lung.

CASE No. XV. (No. 1864.)

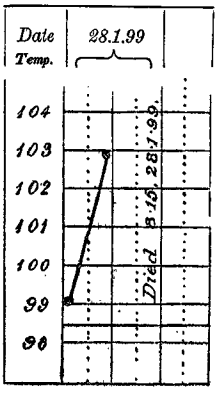


Male. Aged 25. Admitted **15.299.** Ill for two days. Bubo in right femoral region. Patient conscious. Lungs, prolonged expiration at both bases, with rhonchi at the end of expiration. **16.2.99.**—Rather restless. Pulse weak. **17.2.99.**—Condition unchanged, rather worse if anything. **18.2.99.**—Becoming weaker, pulse rapid, very soft. **19.2.99.**—Delirious during night. Now exhausted.

CONTROLS.

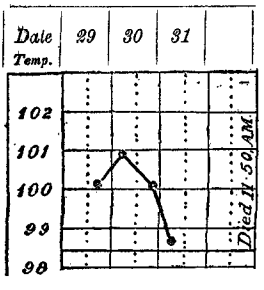
NOTE.—The charts of control cases show the temperature only, observed in the morning and evening each day.

CASE No. I. c. (No. 1652.)



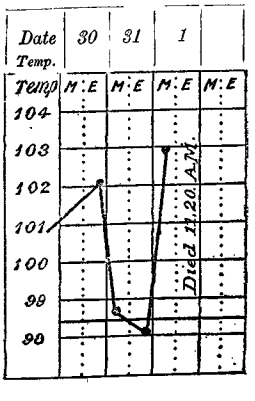
Male. Age 20. Admitted **28.1.99.** Ill two days. Bubo in right femoral region.

CASE No. II. c. (No. 1673.)



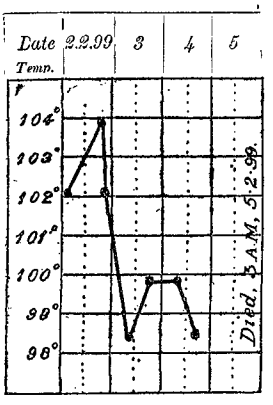
Male. Age 22. Admitted **29.1.99.** Ill three days. Bubo in right axilla.

CASE No. III. c. (No. 1685.)



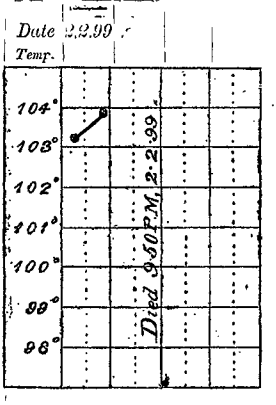
Male. Age 30. Admitted **30.1.99.** Ill two days. Bubo in left popliteal region.

CASE No. IV. c. (No. 1707)



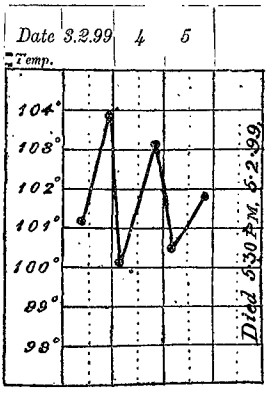
Male. Aged 40. Admission **1.2.99.** Ill six days? Bubo in right groin.

CASE No. V. c. (No. 1714.)



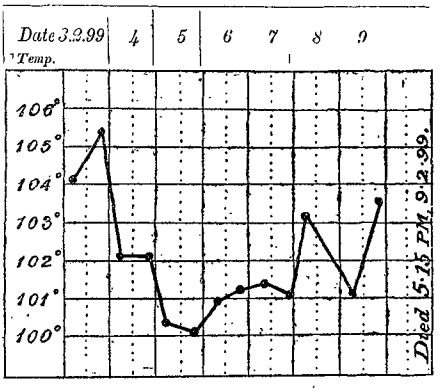
Male. Aged 35. Admitted **2.2.99.** Ill three days. Bubo right femoral region.

CASE No. VI. c. (No. 1725.)



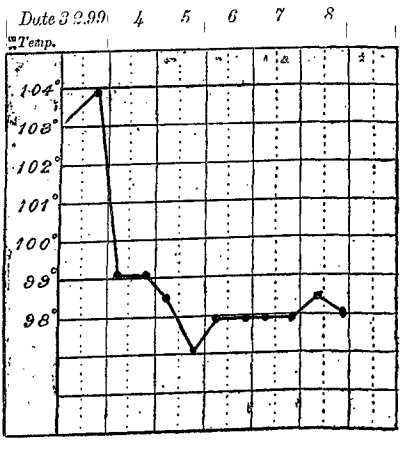
Male. Aged 50. Admitted **3.2.99.** Ill three days. Bubo *in* right femoral region.

CASE No. VII. c. (No. 1729.)



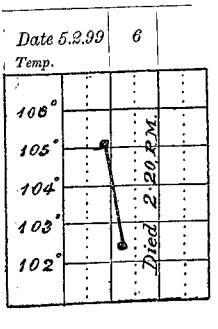
Male. Age 20. Admitted **3 2.99.** Ill for four days. Bubo left groin.

CASE No. VIII. c. (No. 1731.)



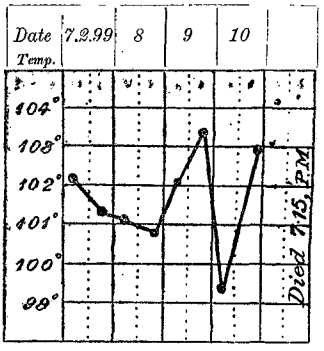
Male. Age 19. Admitted **3.2 99.** Ill for seven days. Bubo in right groin. Discharged cured **13.2.99.** Bubo did not suppurate.

CASE No. IX. c. (No. 1753.)



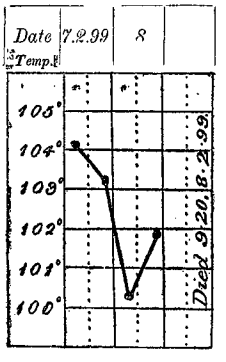
Male. Age 35. Admitted **5.2.99.** Ill for three days. Bubo in right groin.

CASE No. X. c. (No. 1774.)



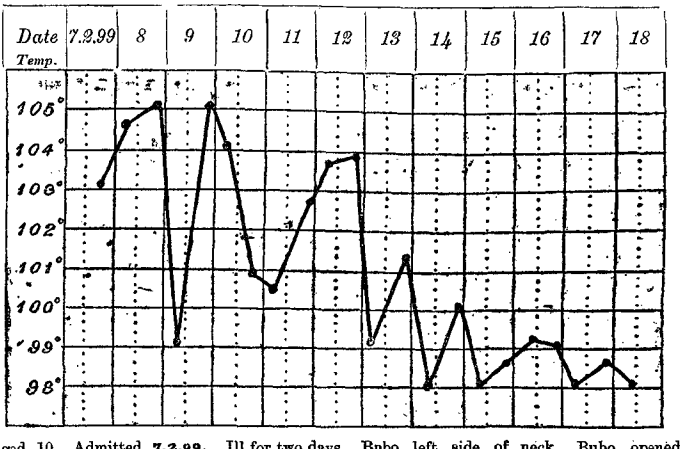
Male. Aged 18. Admitted **7.2.99.** Ill for two days. Bubo in right groin.

CASE No. XI. c. (No. 1777.)



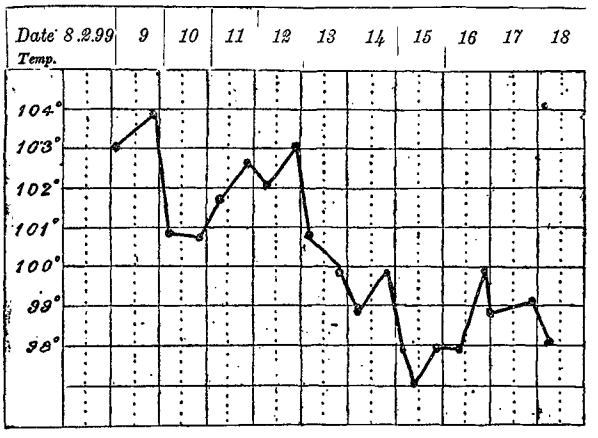
Male. Aged 25. Admitted **7.2.99.** Ill for two days. Bubo in right femoral region.

CASE No. XII. c. (No. 1782.)



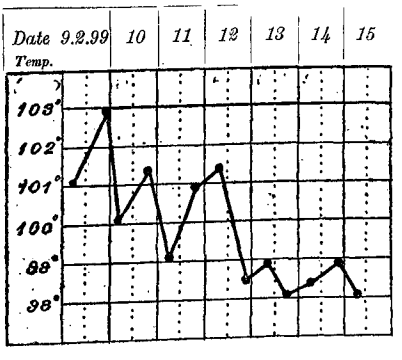
Male. Aged 10. Admitted **7.2.99.** Ill for two days. Bubo left side of neck. Bubo opened **4.3.99.** Developed many (5 or 6) pyæmic abscesses, from which were grown bacilli resembling coli. Discharged well, **23.3.99.**

CASE No. XIII. c. (No. 1891.)



Male. Age 25. Admitted **8.2.99.** Ill three days. Bubo in right femoral region. Bubo opened **16.2.99.** Discharged **23.3.99.**

CASE No. XIV. c. (No. 1807.)



Male. Age 50. Admitted **9.2.99.** Ill for three days. Bubo in left axilla. Bubo opened **24.2.99.** Discharged **17.3.99.**

CASE No. XV. c. (No. ——.)

Notes lost.

Patient died.

Results :—

15 cases treated with serum.
2 recoveries.

15 cases treated without serum.
4 recoveries.

Up to February 7th, 1899, horse 31 serum was used, after that date Horse No. 21.

S. R. DOUGLAS, Lt., I.M.S.

APPENDIX No. LXXXI.

RECORD OF
PLAGUE PATIENTS AT THE MODI KHANA HOSPITAL, BOMBAY,
TREATED WITH M. ROUX' SERUM,
TOGETHER WITH RECORD OF CONTROL CASES,

by

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On Special Duty with the Indian Plague Commission.

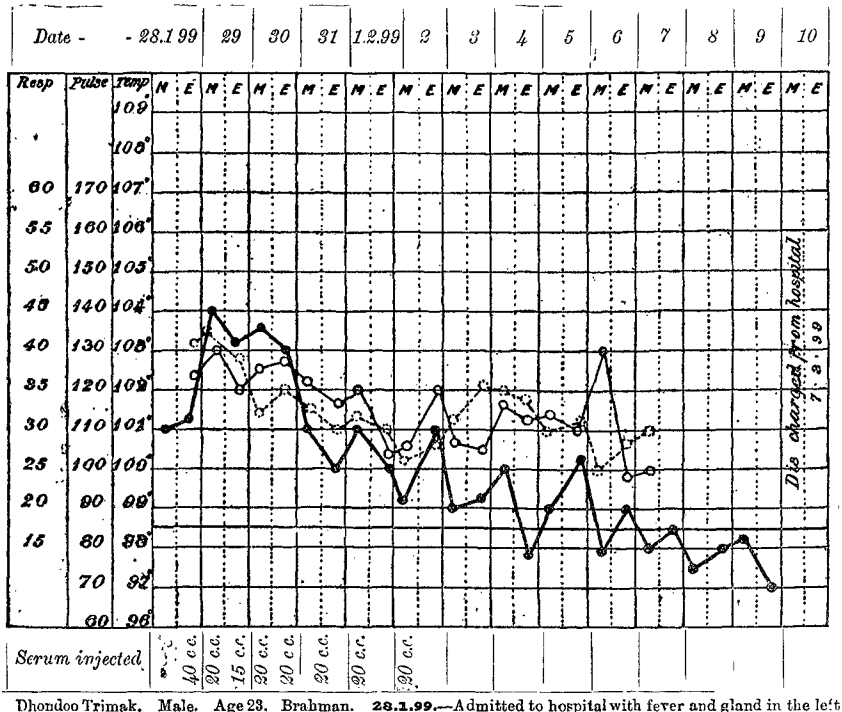
I.

CASES TREATED WITH ROUX' SERUM.

Total number	13
Died	10
Recovered	3
Percentage mortality	76·9

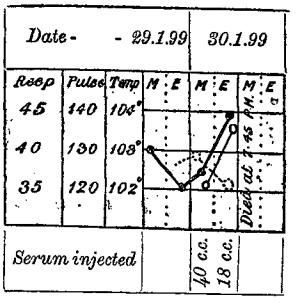
NOTE.—The numbers in brackets at the beginning of each case are those of the Register at the Modi Khana Hospital. The temperature is shown by a thick black line, the pulse by a thin black line, and the respiration by a dotted line.

CASE No. I. (No. 1656 (Control No. 1664).)



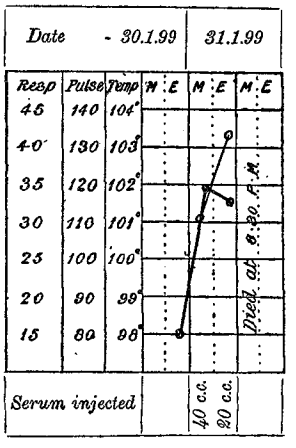
Dhondoo Trimak. Male. Age 23. Brahman. **28.1.99.**—Admitted to hospital with fever and gland in the left axilla. Well developed man. Has been ill for six days. Small tender bubo in left axilla. Is delirious and throwing himself about. Has retention of urine, necessitating catheterisation. 4.30 p.m.—Pulse 128; very poor volume. Temperature 102°. Respiration 32. Tongue thickly coated. Spleen not felt. Liver dulness normal. Heart and lungs normal. A blood film was examined microscopically and blood planted on agar; both gave negative results. 40 *c.c. of serum* in flanks. **29.1.99.**—10 a.m.—Was very delirious all night; quiet and conscious this morning. Pulse 120; better volume. Respiration 42. Temperature 104°. 20 *c.c. of serum*, No. 31. 6 p.m.—Quite quiet and sensible. Heart and lungs again examined and found normal. 15 *c.c. of serum.* **30.199.**—10 a.m.—Quite sensible. Bubo larger. Pulse, fair volume. 20 *c.c. of serum.* 6 p.m.—Condition unaltered. 20 *c.c. of serum.* **31.1.99.**—Quiet and sensible. Volume of pulse steadily improving. Says he feels much better. Tongue cleaning. 20 *c.c. of serum.* **1.2.99.**—Doing very well; talks well. Complains of pain about the bubo. 20 *c.c. of serum.* **2.2.99.**—Slept badly. Retention of urine continues, but passed a small quantity after application of turpentine stupes. Is very weak. 20 *c.c. of serum.* **3.2.99.**—Doing well. Passes urine naturally. Patient gradually improved, and was discharged from hospital on March 7th. 1899.

CASE No. II. (No. 1670 (Control No. 1667).)



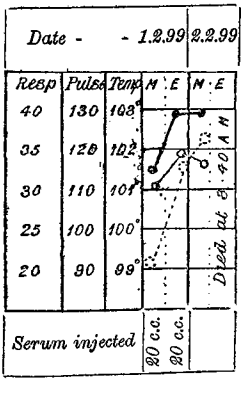
Pandu Mahadu. Male. Age 28. Hindu. Mill hand. **30.1.99.**—10 a.m.—Ill for three days. Small, painful gland in right axilla. Tongue furred at sides, bare in centre. Heart and lungs normal. Quite conscious and talks rationally. Pulse very weak. 40 *c.c. serum.* No. 31. 6 p.m.—Much weaker. 18 *c.c. of serum.*

CASE No. III. (No. 1686 (Control No. 1690).)



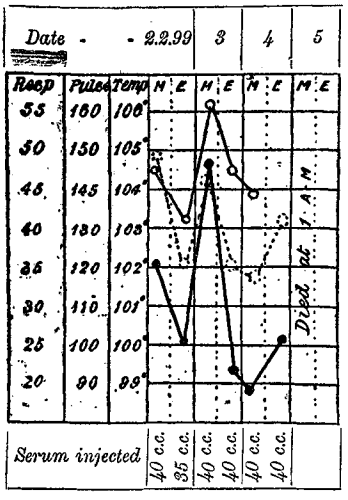
Yanu Paya. Male. Age 40. Hindu. Hamal. **30.1.99.**—Ill for two days. Fever and gland in right femoral region. Is quite conscious and answers questions. Tongue coated. Pulse very compressible and of poor volume. **31.1.99.**—10 a.m.—Small bubo, not very tender. Much œdema around. Heart normal. Lung, râles and rhonchi at both bases behind. Spleen not felt. Liver dulness normal. Conjunctivæ injected. 40 *c.c. of serum,* No. 31. 5 p.m.—Pulse very weak. Patient is semi-conscious. Answers when roused. Alternately drowsy and restless, throwing himself about and picking at the bed clothes. 20 *c.c. of serum* in subcutaneous vein.

CASE No. IV. (No. 1697 (Control No. 1675).)



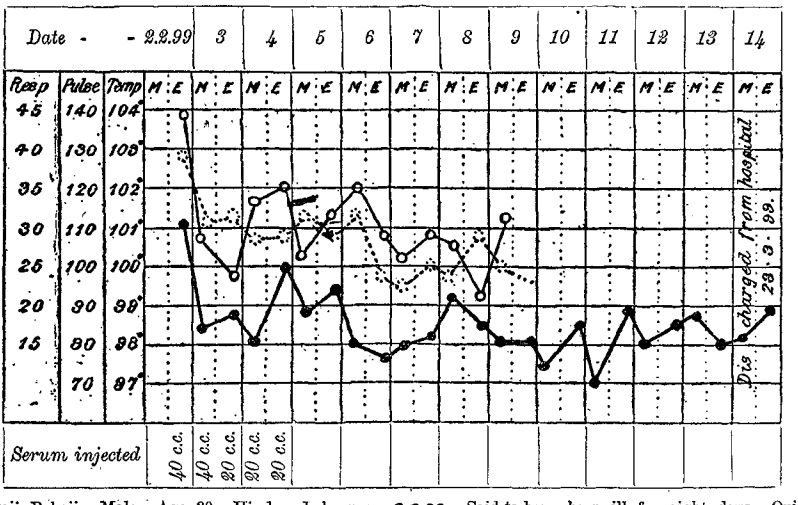
Tatwardas Ramnath. Male. Age 45. Hindu. Mendicant. **1.2.99.**—10 a.m.—Ill for three days. Moderate bubo in left groin. Hard and painful. Eyes injected. Tongue furred all over. Pulse fairly good volume. Heart normal. Lungs. Moist sounds at both bases behind. A few scattered rhonchi, both sides front. Spleen and liver normal. 20 *c.c. of serum,* No. 31. 6 p.m.—General condition fairly good. 20 *c.c. of serum.* **2.2.99.**—Slept fairly well. Pulse became very bad at 6 a.m.

CASE No. V. (No. 1708 (Control No. 1709).)



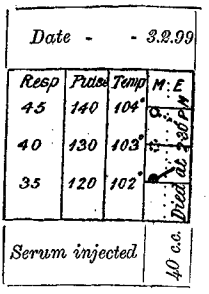
Ghulam Imamdin. Male.-Age 18 (?). Muhammadan. Labourer. **2.2.99.**—10 a.m.—Admitted with fever and gland in right axilla. Extremities cold. Shivering. Semi-conscious, but very drowsy. Tongue coated, eyes injected. Too ill to admit of detailed examination. 40 *c.c. of serum*, No. 31. 6 p.m.—Pulse shows marked dicrotism. Very drowsy. Can scarcely be roused, and then does not understand what is said to him. 35 *c.c. of serum*. **3.2.99.**—10 a.m.—Condition very bad. Noisy delirium and twitching in limbs and facial muscles. 40 *c.c. of serum*. 6 p.m. —Condition unchanged. 40 *c.c. of serum*. **4.2.99.**—10 a.m.—Pulse extremely weak. Lips covered with sordes. Extremities cold. 40 *c.c. of serum*. 5.30 p.m.—Patient appears to be moribund. Profuse sweat on forehead. Picks feebly at the bed clothes. 40 *c.c. of serum*.

CASE No. VI. (No. 1716 (Control No. 1699).)



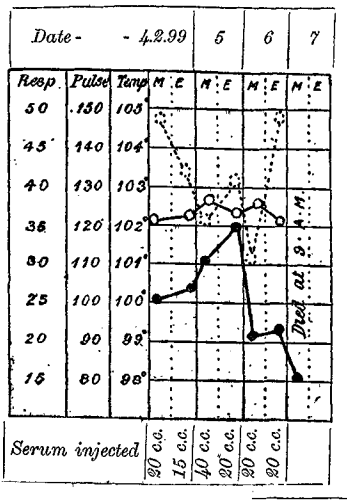
Daji Bobaji. Male. Age 30. Hindu. Labourer. **2.2.99.**—Said to have been ill for eight days. Quite conscious. Eyes injected. Speech slightly affected. Bubo with ulcerated surface in right groin. Râles, rhonchi and bronchial breathing scattered over both lungs. Pulse soft and compressible. 40 *c.c. of serum*, No. 31. **3.2.99.**—10 a.m.—Had a very bad night. Is quite conscious, but very weak this morning. Occasional paroxysms of coughing. Lungs full of râles. Was collapsed for a short time early this morning. 40 *c.c. of serum*. 6 p.m. —General condition bad. Pulse very poor volume. 20 *c.c. of serum*. **4.2.99.**—10 a.m.—Very weak. Cough rather better. Says he feels better than yesterday. 20 *c.c. of serum*. 5.30 p.m.—20 *c.c. of serum*. **5.2.99.**—Distinctly better. Pulse still very weak. **8.2.99.**—Doing well.

CASE No. VII. (No. 1720 (Control No. 1721).)



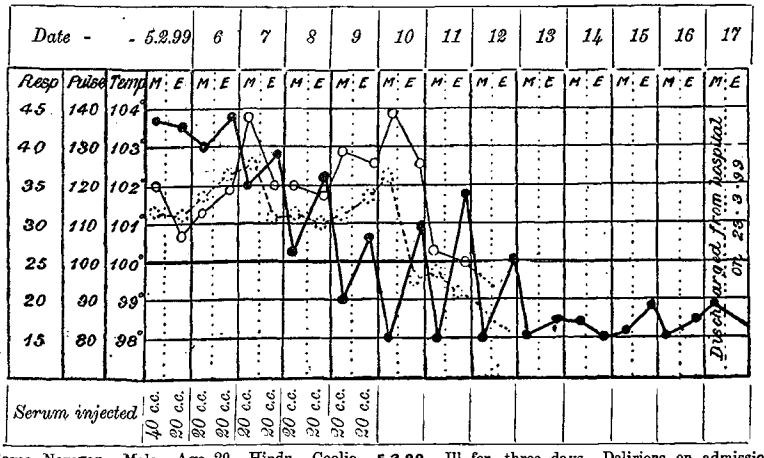
Luxman Rama. Male. Age 35. Hindu. Labourer. **3.2.99.**—About four days ago had a swelling in the right groin, which appeared suddenly, and has been acutely tender since its first appearance. There is a moderate sized bubo in the right groin. Skin has been cauterised over it. Pulse thready. Is conscious, but apparently moribund. Breath and extremities cold. Chest normal. 9.30 a.m.—40 *c.c. of serum.*

CASE No. VIII. (No. 1738 (Control No. 1740).)



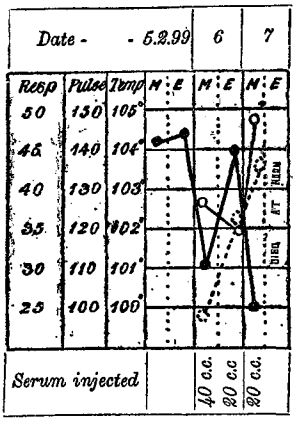
Dhondu Sadu. Male. Age 22. Hindu. Labourer. **4.2.99.**—Admitted with fever and bubo in right femoral region. Has been ill for two days. Eyes not suffused. Is quite conscious. Tongue covered with white fur. Pulse good. Second pulmonary sound, accentuated. Lungs: Patchy, moist sounds, mostly of left side. Much cough. Bubo size of a walnut. Very tender. Spleen not felt. Liver dulness, normal. 10 a.m.—20 *c.c. of serum*, No. 31. 5.30 p.m.—15 *c.c. of serum.* **5.2.99.**—Cough very troublesome. Pulse fair volume. General condition pretty good. 10 a.m.—40 *c.c. of serum.* 10 p.m.—20 *c.c. of serum.* **6.2.99.**—10 a.m.—Patient collapsed with cold extremities, and very feeble pulse. Rallied somewhat after injection of ether and strychnine. Became very bad again at 11 a.m. Much frothy sputum. Chest full of râles. Pulse imperceptible. 20 *c.c. of serum.* 6 p.m.—Moribund. 20 *c.c. of serum.*

CASE No. IX. (No. 1746 (Control No. 1739).)



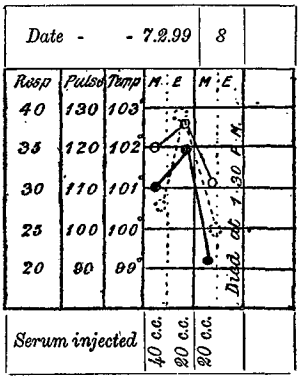
Rama Narayan. Male. Age 29. Hindu. Coolie. **5.2.99.**—Ill for three days. Delirious on admission. Temperature 103·8°. Several contusions about face. Pulse, fair volume. Tongue dry, thick yellow fur. Breath very fœtid. Eyes not suffused. No enlargement of liver or spleen. Bubo. A string of hard, rather tender glands in left femoral region. Heart and lungs, normal. 10 a.m.—40 *c.c. of serum*, No. 31. 10 p.m.—20 *c.c. of serum.* **6.2.99.**—Slept fairly well. Conscious this morning. Pulse 120, weak. Has some cough. 10 a.m.—20 *c.c. of serum.* 6 p.m.—20 *c.c. of serum.* **7.2.99.**—Delirious at intervals. Pulse fairly good. 10 a.m.—20 *c.c. of serum.* 6 p.m.—Pulse not so good. 20 *c.c. of serum*, No. 21. **8.2.99.**—Quiet during the night, but no sleep. Speech very thick. Cough and expectoration. Râles both sides of chest. 10 a.m.—20 *c.c. of serum*, No. 21. 6 p.m.—Semi-conscious. 20 *c.c. of serum.* **9.2.99.**—Condition better. 10 a.m.—20 *c.c. of serum.* 6 p.m.—20 *c.c. of serum.* **23.3.99.**—Convalescence slow.

CASE No. X. (No. 1762 (Control No. 1765).)



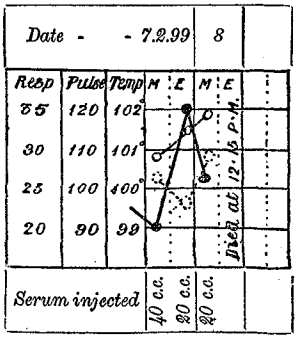
Dhondoo Bhanji. Male. Age 30. Hindu. Labourer. **5.2.99.**—Ill for two days. Admitted with fever and gland in right axilla. Patient is quite conscious. Tongue coated. Eyes injected. Speech slightly affected. **6.2.99.**—Patient is conscious. Speech markedly affected, the ends of words being much prolonged. Tongue tip protruded to left of mid line. No ocular or other paralysis. When talking, from time to time, there is a sort of spasm of the orbicularis oris, which stops his speech. Pulse, poor volume. Bubo in right axilla about size of walnut, very tender. Spleen not felt. Liver normal. Lungs: patches of pneumonia, both bases behind. Heart normal. When left alone, patient mutters incoherently to himself. 10 a.m.—40 *c.c. of serum*, No. 31. 6 p.m.—Condition unaltered. Pulse, very poor volume. 20 *c.c. of serum*. **7.2.99.**—Quiet all through the night. Delirious this morning. Condition very bad. Pulse, imperceptible at wrist. 10 a.m.—20 *c.c. of serum*. Died at noon.

CASE No. XI. (No. 1775 (Control No. 1776).)



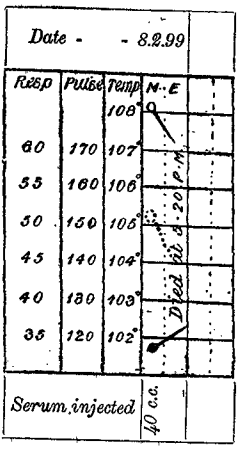
Narayan Ooma. Male. Age 14. Hindu. Peon. **7.2.99.**—Ill for six days. Fever and hard painful gland in left groin. Tongue coated in patches with dry yellow fur. Eyes not suffused. Speech slightly thick. Quite conscious. Heart, spleen, and liver, normal. Lungs. Patches of moist sounds posteriorly in both lungs. Pulse of poor volume. Bubo, size of a walnut. 11 a.m.—40 *c.c. of serum*, No. 31. 6 p.m.—Very weak. 20 *c.c. of serum*, No. 21. **8.2.99.**—No sleep. Very delirious all night. This morning is exhausted. Pulse imperceptible at wrist. Running in brachial artery. Extremities cold. 10 a.m.—20 *c.c. of serum*, No. 21.

CASE No. XII. (No. 1773 (Control No. 1752).)



Kalloo Parbutti. Male. Age 25. Hindu. Labourer. **7.2.99.**—Ill for two days. Admitted with fever and gland in right axilla. Dorsum of tongue covered with dry brown fur. Eyes injected. Speech not affected. Is quite conscious. Pulse poor volume, but regular. Heart, lungs, spleen, and liver normal. Much œdema around the bubo. 11 a.m. —40 *c.c. of serum*, No. 31. 6 p.m.—Pulse very poor. 20 *c.c. of serum*, No. 21. **8.2.99.**—Noisy delirium. Pulse almost imperceptible. 10 a.m. —20 *c.c. of serum*, No. 21.

CASE No. XIII. (No. 1786 (Control No. 1787).



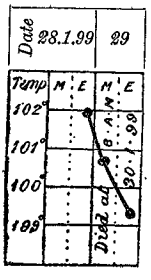
Sakharam Krishna. Male. Age 12. Hindu. Labourer. **8.2.99.**—Four days ill. Bubo, left axilla. Tongue coated. Speech not affected. Eyes somewhat injected. Heart normal. Lungs. Harsh breathing over whole of left chest. Liver and spleen, normal. Pulse, running about 180. 11 a.m. —40 *c.c. of serum*, No. 21. 5 p.m.—Had a short convulsive fit.

II.

CONTROL CASES, to those TREATED WITH ROUX' SERUM.

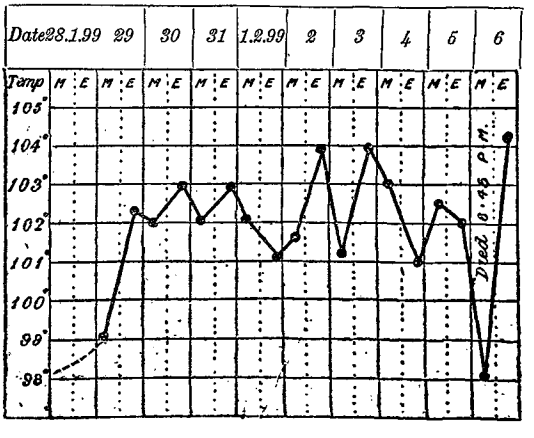
Total number - - -	13
Died - - - -	13
Percentage mortality -	100

CASE No. I. c. (No. 1664 (Control to No. 1656).)



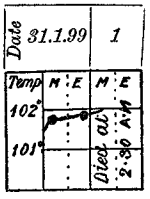
Anandroo Gennoo. Male. Age 20. Hindu. Labourer. **28.1.99.**—Ill for two days. Right femoral bubo. Tongue coated. Pulse very feeble. **29.1.99.**—Slept well. Pulse very feeble and rapid.

CASE No. II. c. (No. 1667 (Control to No. 1670).)



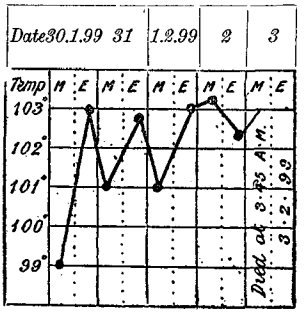
Luxman Yessoo. Male. Age 18. Hindu. Carpenter. **28.1.99.**—Ill for two days with fever, and painless hard swelling on the right side of the neck; says that the swelling is of long duration. **30.1.99.**—The swelling in the neck is becoming painful. Tongue coated. Eyes red. **1.2.99.**—Bubo about the same, still hard. **2.2.99.**—Small glands have appeared in both femoral regions. Patient very restless. **3.2.99.**—Had a fairly good night. Condition fairly good. **4.2.99.**—Is delirious this morning. Pulse of good volume. Cervical bubo incised, very little pus. **5.2.99.**—No sleep. Eyes much injected. Pulse fairly good in the morning.

CASE No. III. c. (No. 1690 (Control to No. 1686).)



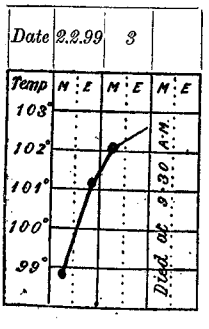
Dhondu Narayan. Male. Age 18. Hindu. Labourer. **31.1.99.**—Admitted to hospital with fever and gland in the right axilla. Semi-conscious. Speech affected. Tongue coated. Pulse very weak.

CASE No. IV. c. (No. 1675 (Control to No. 1697).)



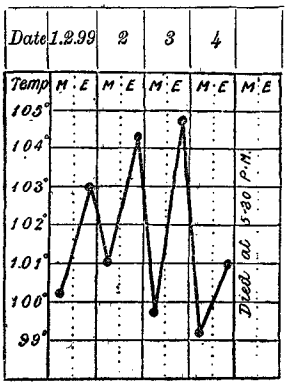
Madhoo Rama. Male. Age 25. Hindu. Polisher. **30.1.99.**—Ill for four days. Speech slightly affected. Small gland in right groin. Not tender. **31.1.99.**—Gland more prominent. **1.2.99.**—Delirious last night. Extremities rather cold. Tongue furred. Very noisy. **2.2.99.**—Slept well. Is quiet this morning. Pulse weak. Respiration hurried.

CASE No. V. c. (No. 1709 (Control to No. 1708).)



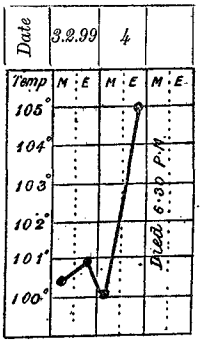
Barbosa. Male. Age 30. Christian. Servant. **2.2.99.**—Ill for six days. Admitted with fever and gland in left femoral region. Skin over the bubo is ulcerated. Tongue coated, eyes suffused. Bowels constipated. Speech somewhat affected. Pulse rapid and soft. **3.2.99.**—Pulse very feeble. Extremities cold. Very restless. Cannot swallow.

CASE No. VI. c. (No. 1699 (Control to No. 1716).)



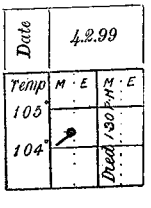
Takaram Babaji. Male. Age 40. Hindu. Carpenter. **1.2.99.**—Ill for two days. Has a cough, which he says is of long standing. Fever dates from two days ago. Tongue slightly coated. Has a chronic glandular enlargement in the right groin. **2.2.99.**—The glands are more painful. Pulse fair. **3.2.99.**—Restless during the night. Gland decidedly more painful and bigger. Pulse fair. **4.2.99.**—Cough troublesome. Delirious during the night. Pulse still fairly good.

CASE No. VII. c. (No. 1721 (Control to No. 1720).)



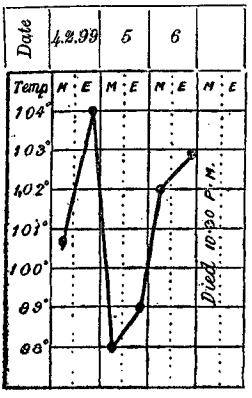
Bhaja Visram. Male. Age 15. Hindu. Labourer. **3.2.99.**—Ill for eight days. A swelling, in the right groin, appeared eight days ago, without fever. Was not painful at first. Four days ago, had fever, with slight shivering. Is now restless and delirious. Eyes injected. Tongue coated. Pulse very soft. Extremities cold. **4.2.99.**—Had no sleep. Pulse fairly strong. Tongue very coated. Appears to be more conscious.

CASE No. VIII. c. (No. 1740 (Control to No. 1738).)



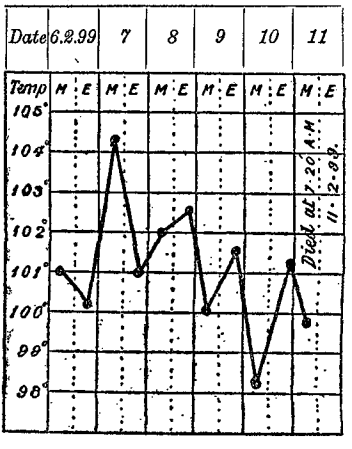
Ganoo Rawji. Male. Age 40. Hindu. Labourer. **4.2.99.**—Ill for six days. Admitted with fever and bubo in right axilla. Tongue coated. Eyes injected. Pulse feeble. Respiration hurried. Speech not affected. Slight hæmoptysis. Ecchymosis over chest and abdomen.

CASE No. IX. c. (No. 1739 (Control to No. 1746).)



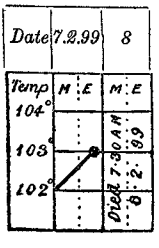
Dhakoo Bhikoo. Male. Age 25. Hindu. Labourer. **4.2.99.**—Ill for three days. Admitted with fever and bubo in left axilla. Is conscious. Tongue coated. Speech not affected. Eyes somewhat injected. Says that his fever began with rigors, and that he noticed the gland on the same day. Pulse rapid, but of fair volume. **5.2.99.**—Was noisy and delirious all night. No sleep. Pulse rapid and of poor volume.

CASE No. X. c. (No. 1765 (Control to No. 1762).)



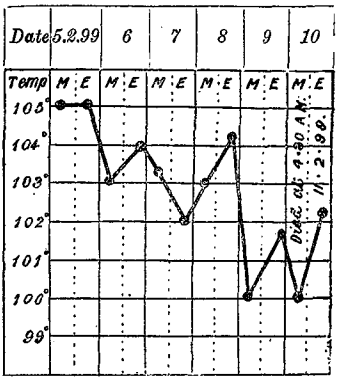
Takhoram Bhagu. Male. Age 9. Hindu. Labourer. **6.2.99.**—Ill for three days. Admitted for fever and bubo in right groin. There are two small glands, which are very tender. Speech somewhat thick. Pulse, soft and compressible. **7.2.99.**—Had no sleep. Delirious this morning. Very thirsty. Pulse very feeble. **8.2.99.**—Very restless and noisy, but slept up to 7.0 a.m. Pulse feeble. **9.2.99.**—More quiet to-day. **10.2.99.**—Was noisy and restless until midnight. Pulse very weak, *extremities* rather cold.

CASE No. XI. c. (No. 1776 (Control to No. 1775).)



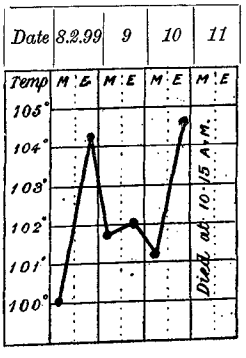
Dhanu Joti. Male. Age 40. Hindu. Labourer. **7.2.99.**—Ill for two days. Fever and gland in right groin. Tongue coated. Eyes injected. Some cough. Pulse soft and rapid. Bubo consists of three small painful glands.

CASE No. XII. c. (No. 1752 (Control to No. 1773).)



Ram Chandra Essoo. Male. Age 24. Hindu. Labourer. **5.2.99.**—Has been ill for three days. Fever commenced with shivering. Speech markedly affected. Is conscious. Spleen normal. **6.2.99.**—Tongue furred. Condition fairly good. **7.2.99.**—Complains of pain in the right groin, where there is a small bubo. Tongue coated. Pulse rapid and soft. **8.2.99.**—Noisy at times. Pulse weak. **9.2.99.**—Pulse bad. **10.2.99.**—Slept a little, but was restless during the past night. Pulse rapid and weak.

CASE No. XIII. c. (No. 1787 (Control to No. 1786).)



Korida Kristoo. Male. Age 18. Christian. Clerk. **8.2.99.**—Ill for two days. Fever and bubo in left axilla, which appeared last night, and is very tender. Tongue furred. Lungs clear. There was another plague case in the same house two days ago. Condition good. **9.2.99.**—Says the bubo is less tender. **10.2.99.**—Diffused swelling around the bubo. Tongue much coated. Pulse weak and rapid.

APPENDIX No. LXXXII.

(*See* Question No. 26,508.)

Letter No. 260A of 1898.

From W. M. HAFFKINE, Esq., C.I.E., to the SECRETARY TO THE GOVERNMENT OF INDIA, Home Department, Simla.

Plague Research Laboratory,
Mazagáon, Bombay, June 7, 1898.

SIR,

I HAVE the honour to forward a note by Surgeon Lieut.-Col. Warden, on the work done by him in this laboratory in connexion with the preparation of peptone from goat's meat, by digesting it in acidulated water.

As the result of this work, a preparation now entirely manufactured in the laboratory has been substituted for commercial peptone.

The following is the formula of that preparation:—

1,000 grammes of goat's meat mixed with 2,000 grammes of water and 150 c.c. of hydrochloric acid, and heated for 5½ hours in an autoclave under 2½ kilos of pressure.

The filtrate is mixed with 45 grammes of caustic soda and 75 grammes of common salt, heated further under two kilos of pressure for half an hour, filtered, and the volume of the filtrate brought, by addition of water, up to 3,000 grammes.

For the preparation of the medium in which the plague prophylactic is cultivated, one part of the above solution is mixed with nine parts of neutralised goat's meat extract, obtained by boiling fresh goat's meat in 18 volumes of water. The surface of the liquid is then covered with a thin layer of minute droplets of ghee (clarified butter).

The plague prophylactic is the result of a prolonged fermentation produced in the above medium by the plague bacillus, *plus* the bodies of the bacilli themselves killed by maintaining them for an hour at a temperature of 65° C.

2. Apart from the substitution of peptonised goat's meat for commercial peptone, no modification is, for the present, introduced in the preparation of the plague prophylactic, as adopted after the tests in the Byculla House of Correction and the Umarkhadi Common Jail, in Mora, in Damaon, Bombay, Lonaula, Kirkee, Undhera, and in the Bombay Khoja community.

The observations collected in the above epidemics have demonstrated that the plague prophylactic possesses the two properties which were aimed at in our programme, viz., the power of reducing the number of attacks amongst the inoculated, when compared with uninoculated, and the power of reducing the number of deaths in inoculated attacked, when compared with the attacked uninoculated. The observations have shown that the two effects combined amount to a final reduction of between 80 and 90 per cent. of death in inoculated, when compared with the uninoculated exposed to the same epidemic.

These properties of the plague prophylactic may now be considered as an established fact which is not likely to be shaken by any further tests or experiments; and no sudden alteration in the nature of the drug is desirable. This is because it is impossible to say for certain whether the above results were obtained just in the way I imagined they would, and in answer to the theoretical conjectures which guided me. Future alterations and improvements must be made gradually, and in conformity with those conjectures, which will be confirmed or refuted only by a critical scrutiny of results.

In the course of my observations on the inoculated against cholera I formed the idea that the invasion of an individual by morbid microbes is very effectively controlled by a treatment with preparations made of the bodies of microbes, but that the issue of the disease when invasion has not been prevented is not influenced by such a preparation. On the other hand, the fact that almost in all infectious diseases, studied up to now, the morbid organism remains present in the patient for a long time after recovery, without causing any inconvenience, goes to show that recovery is a phenomenon essentially different from the resistance to microbial invasion, or from the ridding of the body of such microbes after invasion.

The strengthening of the organism for a struggle against morbid symptoms should be sought for in a treatment with preparations made from the products of microbes, not from the bodies of the microbes themselves.

Confirmation or otherwise of these views may result from cautious attempts at improving the results of the plague inoculation.

For the present the plague bacilli introduced into the fermentation medium are permitted to grow there for an average of four weeks; after this they are killed, but left in liquid. The mixture combines at once a large amount of bodies of microbes, corresponding to the vaccines used in cholera, with the products secreted into the liquid, which are not present in the cholera inoculation. In the interest of the last ingredient it is desirable that the fermentation should be maintained as long as possible, much longer than the period given above, and extended, if possible, for months; in the interest of the microbial preparation, on the contrary, the cultivation should be as young and vigorous, and as unaltered by age, as possible.

The method at present used was selected as presenting a great simplicity of execution; and the period of four weeks was taken as being an average not so long as to cause a complete deterioration of the microbes, and yet long enough for the accumulation of a certain amount of fermented products.

The first step for improving this preparation should consist in separating the above two operations, viz., in cultivating fresh microbial vegetation separately, in a way similar to that used in cholera, and in maintaining, apart from this process, a fermentation in liquid media for periods longer than it is possible at present. The mixture of the two materials should be made artificially, and the result of the modification carefully studied in epidemics. The addition of fresh crops of microbes should reduce further the number of cases, while the use of cultures of older age should increase the resistance to the symptoms of the disease.

The problem of reducing the discomfort caused by the preventive inoculation, may possibly be solved by modifying the vaccine. It appears that, of the two elements constituting the present plague prophylactic, the liquid part, filtered or decanted off the solid residue, causes the rise of temperature observed after inoculation; while the solid part suspended in the liquid is responsible for the pain developing in the seat of inoculation. Under the effect of chemical and physical agencies the liquid loses its power of producing fever. On the other hand, it is possible that the solid residue may be modified mechanically or by dissolving it in chemicals, so as to cease to cause the local reaction. Whether such modifications are compatible with the maintaining of the protective power of the prophylactic can be solved only by direct observation, and by cautious and gradual attempts.

Lastly, an important problem in connexion with the manufacture of the prophylactic consists in fixing the pathogenic properties of the microbe so as to ensure uniform and accurately measurable effect. This has not been done up to now, chiefly on account of the difficulties of procuring animals, and in the interest of simplicity in the operations; but as this prophylactic does not contain living microbes, and is a fixed chemical drug, it was sought to compensate the alterations in the fermenting organism by modifying the doses of the drug. The result obtained with the weakest material up to now used amounted to the suppression of 77·9 per cent. of deaths in inoculated compared with the uninoculated, as was observed in the outbreak in the native followers of the Artillery at Kirkee.

Although, therefore, the plague prophylactic admits, and, it is to be hoped, will for a long time continue to admit, of many useful modifications, it may be considered that the question at issue has been, for practical purposes, solved by the experiments and observations made up to now; and I have no hesitation in recommending as wide an encouragement of the adoption of the method as possible, with the understanding that the treatment is optional, and offered as a voluntary substitute for the separation of the sick and healthy, and their removal from the place of habitation.

I have, &c.

Sd. W. M. HAFFKINE.

APPENDIX No. LXXXIII°

STATEMENT HANDED IN BY M. HAFFKINE

REGARDING THE

ANTI-PLAGUE PROPHYLACTIC.

(This Statement is published at Mr. Haffkine's desire.)

On the 7th June 1898 I addressed to the Government of India a letter, No. 260A, in which the following three problems were put down in connection with the further development of the inoculation against the plague:—

(1) The first referred to the separation of the manufacturing of the bodies of the plague bacilli and of the metabolic substances, the mixture of which constitutes the plague prophylactic;

(2) the second to the mitigation of the local effect caused by the inoculation; and the third to

(3) the fixing of the properties of the plague bacilli so as to permit of a more accurate standardizing of the prophylactic.

The above problems, as well as several others, were early recognised as urgent in the Plague Research Laboratory. Unfortunately, the rapid spread of the epidemic, and the necessity of meeting the demands for prophylactic while the epidemic lasted, entailed such an amount of current work that, up to the present time, I was unable to sufficiently attend to their solution, though many attempts in the above direction have been already made in my Laboratory. I have requested now the Government to kindly give me a senior Assistant, to whom I could delegate the administration of the current Laboratory work, and thus be set free to attend to further inquiries. I have fair reasons to hope that the above request will be granted, and the problems mentioned above will be persistently and carefully pursued.

Among the problems enumerated I have not mentioned the one announced to the public by the Medical Officers at Hyderabad, the reason being that that problem of keeping the material free from common microbes is one that has been always the object of much care in the Laboratory. The Commission, however, knows that to attain that object in a complete form is not always feasible, and that such a state of affairs is not fraught with danger. Thus, for instance, there is no possibility of having a vaccine lymph for small-pox free from foreign microbes. The lymph taken direct from a vesicle of a calf almost without exception contains already extraneous microbes, that can be seen under the microscope and cultivated in nutritive media. When the lympth is squeezed out of the vesicle, it comes further in contact with the surface of the calf's skin, and with all the microbes adherent to it. These microbes cannot be killed in vaccine lymph, which is itself a living matter, as by doing so, the lymph itself is killed. The only thing that can be, and is done, is to prevent the foreign microbes from multiplying in the material, and this is to a great extent obtained, for instance, by the addition of glycerine to the lymph. The result, of course, is perfectly satisfactory. Every one has seen frequently in this country, in villages, batches of 200—300 children at a time, paraded in the streets with their vaccinated arms outstretched before the Inspectors of Vaccination, without a single case of complication due to those common germs being observed.

The plague prophylactic admits of being prepared with a far greater freedom from those common microbes than is the case with the vaccine lymph. To attain, however, this object fully, better conditions of work are required than those that we could command up to late. We had to work in the Laboratory with a staff of subordinates that were not prepared for bacteriological work, and with materials and appliances that we had to buy urgently at Bhendi Bazar, and at Abdul Rahman Street in Bombay. The Government Medical Stores did their utmost to procure for us supplies. At one time, however, they were able to get for us only bottles for which no corks of suitable size could be got; and afterwards, when the corks became plentiful, there were no more bottles in Bombay to suit fittingly the corks. Into a large number of such bottles common microbes penetrated after the material had been corked and sealed, owing to their deficient corking and sealing. In other instances, among the bottles prepared and sterilized for being filled up with the prophylactic there were such as had escaped complete sterilization. For effecting such, it is necessary that the temperature in the steam sterilizer should be raised 10° to 15° C. above the boiling point. Whenever, owing to the defect in the registering apparatus, or to other reasons, the bottles are subject to a lower temperature, complete sterilization is not effected. This, however, is no source of serious risk. Every one knows, for instance, that a surgeon preparing for an operation on a patient is perfectly safe if he keeps his instruments for a quarter of an hour in boiling water. No surgeon ever sterilizes his instruments at a higher temperature. The reason of this is that the temperature of boiling water kills all *pathogenic* microbes, capable of causing diseases; and though the instruments, when taken out of the water and put into cultivation media, will always show a number of living germs sticking to them and which have escaped the effect of boiling, these germs are harmless, as are harmless all those innumerable microbes that we eat and drink and breathe in our daily life, or as is harmless an apple, or an onion, or a mango, or any other living vegetable or fruit that we eat uncooked.

Whenever, therefore, steam is formed in the sterilizer, and the bottles remain there, be it for a quarter of an hour only, they become safe as to the risk of having in them microbes causing disease; but if the temperature is not raised high enough *above* that point, there will remain common microbes in those bottles and they may be found subsequently in the prophylactic put into those bottles. Such microbes will be capable of growing when transferred into cultivation media; as an apple is capable of growing when put into the soil. In a number of cases these microbes will be killed by the ½ per cent. of carbolic acid contained in the prophylactic. There are other microbes that will not be killed by that antiseptic, but their growth and multiplication will be arrested, as glycerine arrests the growth of microbes in vaccine lymph, which is all that is required in the case. But some microbes resist even that effect, and it is the latter that it is desirable to avoid. This can be done sucessfully and very easily in ordinary quiet times, and even in times of urgent and hasty work when the Laboratory gets fully officered, and all the officers get to know their work. During the last epidemics in Hubli, Dharwad, Gadag, Bangalore, those were not the conditions that obtained, and we had to consider whether we were justified in doing our work and supplying urgently those places with prophylactic under the then existing conditions or not. We decided that we were, and I have no doubt every

one will share our view when it is considered how much the facts justified our calculations. This can be easily done from any concrete instance.

The Commission have it on evidence from the medical officers who were in charge of the plague operations at Hubli, during the last epidemic there, that they performed 78,000 injections with the plague prophylactic in that town alone, and that in these operations they observed 12 cases where the injection caused complication in the shape of abscesses. All these 12 abscesses subsequently healed up, and no complications of any other nature have ever occurred —in this respect they were perfectly emphatic. The facts collected in Hubli show that the total number of deaths that took place there during the epidemic was 2,755; but that if no inoculation had been done, and the death-rate in the whole population had been equal to that observed in the uninoculated, 24,899 would have died. The inference is that the inoculation with the plague prophylactic saved 22,144 lives. In adopting the plan of work which the best of our knowledge suggested to us as correct and safe, the officers of the Plague Research Laboratory admitted the risk of causing *one* abscess that subsequently healed up, for each 1,835 lives that they have saved.

I beg, however, the Commission to believe me that we are doing our very utmost to avoid even the possibility of that *one* abscess.

In conclusion, permit me to express my regret, if it so happened that the Hyderabad Medical Officers, who startled the public by their statements and deterred a very large number of unknowing people from taking advantage of inoculation, had the requisite knowledge for estimating the above considerations, but represented the case to the public in an incomplete form. On the other hand, I have no reproach to address to them if they acted when being themselves under a misapprehension.

(Signed) W. M. Haffkine.

Bombay, March 22nd, 1899.

DIAGRAM shewing weekly mortality in Bombay: June 1896 to May 1899.

Appendix No LXXXIV.
(See Question No 26,540)

Appendix No LXXXIV.

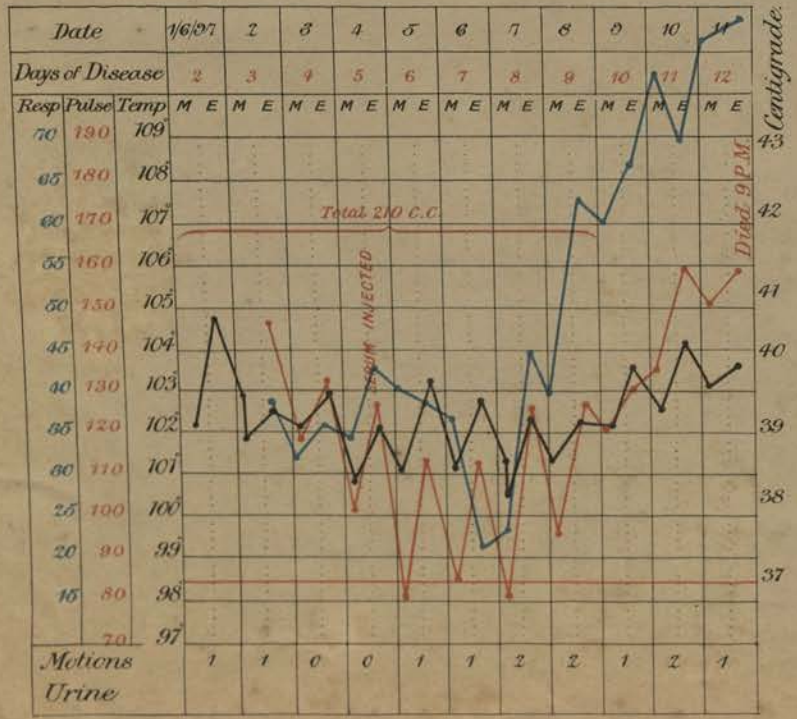
647

CLINICAL CHARTS OF CASES TREATED WITH ROUX' SERUM.

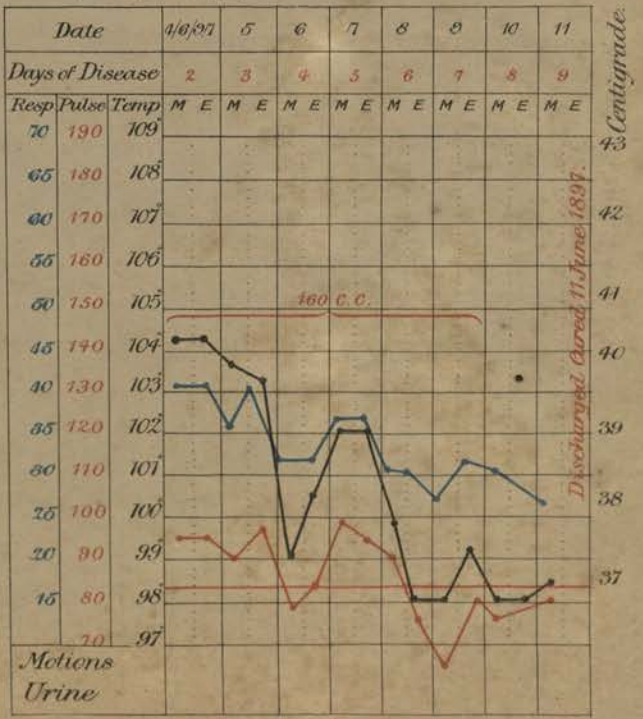
IN THE CUTCH STATE.

BY CAPT. H. D. MASON, R.A.M.C.

1. SIVJI HIRJI. Male. Aged 8.
(Brahmapuri Hospital.)



2. GODAVERIBAI. Female. Aged 30.
(Brahmapuri Hospital.)

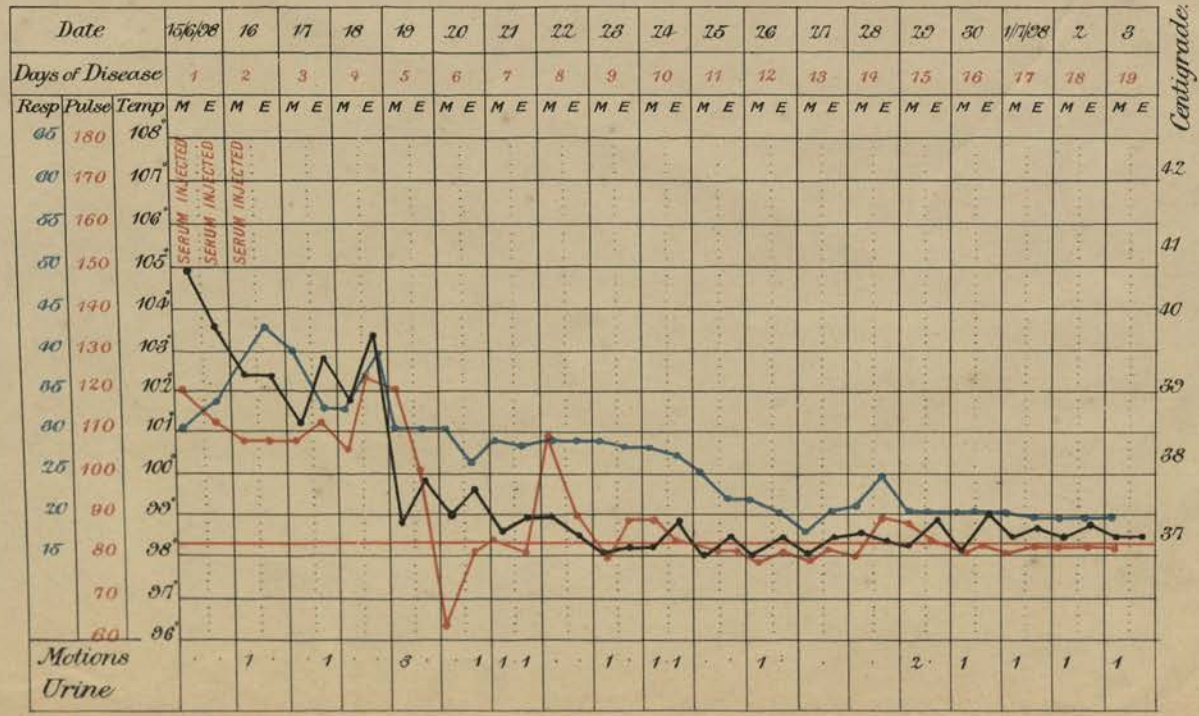


CLINICAL CHARTS OF CASES TREATED WITH ROUX' SERUM.

IN THE CUTCH STATE.

BY CAPT. H. D. MASON, R.A.M.C.

3. MUHAMMAD. Male. Aged 10.
(Muhammadan Plague Hospital.)



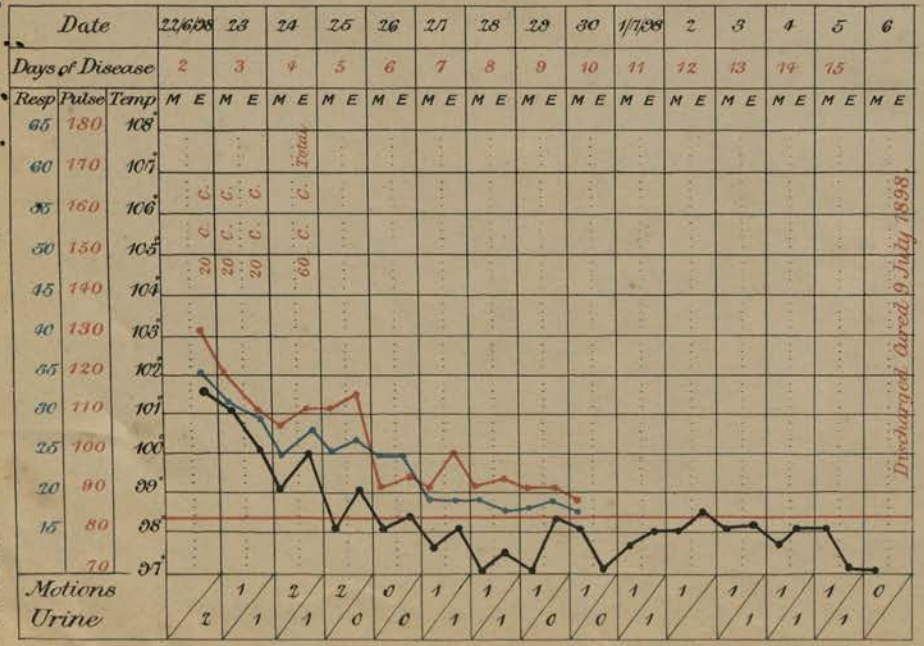
APPENDIX No. LXXXV. (See Question No. 27,049.)

CLINICAL CHARTS OF CASES TREATED WITH ROUX' SERUM.

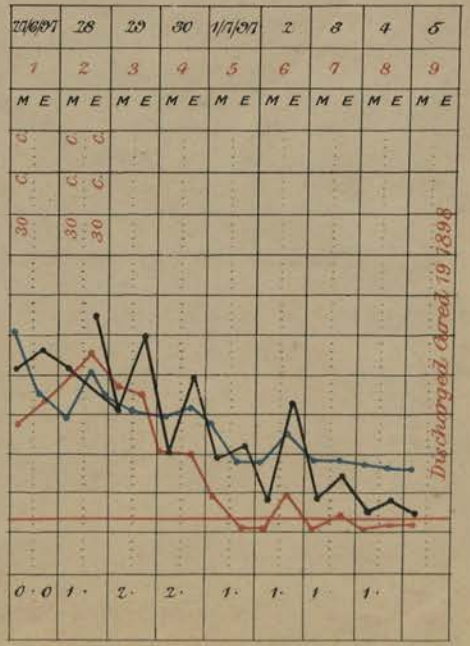
IN THE CUTCH STATE.

BY CAPT. H. D. MASON, R.A.M.C.

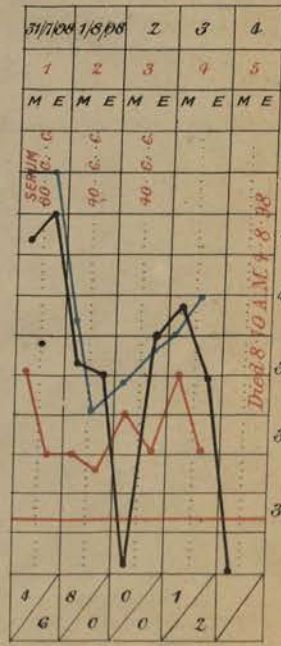
4. CONBAI OOMUAGI. Female. Aged 50.
(Brahmapuri Hospital.)



5. KHANAMISA. Male. Aged 11.
(Muhammadan Plague Hospital.)



6. HASSAN SULEMAN. Male. Aged 35.
(Muhammadan Plague Hospital.)



APPENDIX No. LXXXV.

APPENDIX No. LXXXVI. *

The following abstract of the evidence, which he was prepared to give before the Indian Plague Commission, was submitted by Brigade-Surgeon Lieutenant-Colonel D. D. Cunningham, I.M.S., M.B., F.R.S., C.I.E., and as the witness was unable, through ill-health, to appear for examination, it is published as an Appendix to the Proceedings of the Commission.

I can say little regarding the clinical phenomena presented by the individuals who were supposed to be suffering from plague in Calcutta in the latter part of the year 1896. The number of suspected cases was very limited and the only ones which I saw were some men of the Shropshire Regiment, who were suffering from chronic inguinal and femoral buboes similar to those which were on record as having been of periodic occurrence in the Station Hospital for many years previous, and a case in the Howrah Hospital, which was suspected because the patient had recently returned from Bombay, but which, by observers better qualified to form an opinion regarding it than I was, was regarded as presenting a history and clinical features indicative of venereal origin.

I had, however, ample opportunity of examining the question from a bacteriological point of view, the materials at my disposal being of the following nature:—

I. Type-specimens of cultivations of plague bacilli from Bombay, supplied by Messrs. Haffkine and Hankin.

II. Type-specimens of cultivations derived from the blood of cases of disease in Calcutta and the neighbourhood and supposed by some observers to demonstrate the presence of the plague bacillus.

III. A corresponding series of microscopic preparations of blood and the growths in cultivations.

IV. Cultivations and preparations of blood personally obtained from suspected cases of disease in Calcutta.

V. Specimens of dead and moribund rats from Calcutta and cultivations and microscopic preparations derived from their organs and blood.

The materials, which were supplied by the Health Officer of Calcutta as specimens of growths of plague bacilli from the blood of cases of disease in Calcutta, consisted of cultivations of various distinct species of schizomycete organisms, but none of them presented the distinctive features, either macroscopic or microscopic, of growths of the plague bacillus, and the majority were unequivocally results of aerial contamination, as was clearly demonstrated by the results of a series of experiments in which specimens of the blood of various species of animals were exposed to the influence of contact with the air of the laboratory, in which I was working, for periods of longer or shorter duration. The following example will serve to illustrate the nature of the procedure adopted and the results obtained in these experiments:—

Specimens of blood were drawn directly from the jugular vein of a healthy fowl into two sterilised test-tubes plugged with cotton wool. One of the tubes was kept continuously plugged during a period of three weeks' duration without showing any signs of the presence of any schizomycete contamination; the coagulum contained in it never underwent any contraction, save the small amount incident on evaporation, the formed elements remained well preserved throughout, and cultivations and microscopic preparations, derived from it at the close of the period, failed to yield any evidence of the presence of any schizomycete organisms. The blood in the other test-tube was, shortly after it had been obtained, decanted into half-a-dozen sterilised watch-glasses, which remained exposed to the air for about twenty minutes and were then enclosed within a sterilised moist chamber. Decomposition rapidly set in in all the specimens and, within the course of a few days, the latter yielded abundant growths of various schizomycetes—two species being identical with and subsequently yielding pure tube-cultures of two of the so-called plague bacilli supplied by the Health Officer. The other specimen of blood was eventually exposed in watch-glasses in similar fashion and yielded like results.

The microscopic preparations of blood and of corresponding cultivations obtained from the Health Officer in no case showed any satisfactory evidence of the presence of any true plague bacilli. Certain of the preparations of blood did contain schizomycetes, but these had the form of elongated rods, and in one instance were common large aerial putrefactive bacilli. No fixative had been employed in the preparation of the specimens of blood, and consequently fragments of chromatin abounded in most of them, and may have been mistaken for schizomycete organisms. Some of the preparations, which were labelled as having been derived from the blood and tissues of a rat, which had died in consequence of inoculation of a cultivation of blood derived from a suspected case of plague, certainly did contain numerous schizomycetes, but, as these did not present the characters of plague bacilli, and as the material injected had consisted of 1 c.c. of decomposing broth, or an amount equivalent to about 300 c.c. for an ordinary human adult, neither the fatality attending the procedure nor the presence of schizomycete organisms in the blood and tissues of its victim can be regarded as of any special significance.

The microscopic preparations and cultivations of blood which I myself made were derived from the suspected cases of plague already alluded to as having been personally inspected, and in not a single instance afforded any evidence of the presence of schizomycete organisms of any kind; the specimens of blood were of perfectly normal character, and the cultivations remained, without a single exception, absolutely sterile.

There can be no question that there was a considerable amount of mortality among common house-rats for some time in certain parts of Calcutta during the latter part of 1896, and this was, not unnaturally, regarded by those who affirmed the existence of plague in the city as a strong confirmation of the correctness of their view. Very much stress cannot, however, be laid on the phenomenon of the occurrence of destructive epidemics among rodents unless the precise nature of the disease have been unequivocally demonstrated. Anyone who has had any practical experience of gardening in Calcutta must have had ample opportunity of observing the extraordinary fluctuations in the number of common palm-squirrels and Indian mole-rats — *nesocia bengalensis* — which periodically recur and which can apparently be only accounted for as the result of fatal epidemics on a very large scale. During the earlier half of the decade, 1880–89, the numbers of both these rodents was very great, and latterly so excessive as to be the cause of much damage. An abrupt and excessive decrease followed, and for some years both species were very rare; this was succeeded by a gradual increase, and by the year 1896—the last complete year which I spent in Calcutta—the numbers of both species had once more become troublesomely high. I had an experience of the actual occurrence of a similar epidemic in the forest clothing the slopes of

Mainom—a mountain in Sikkim—in the autumn of 1889, when, in the course of one day's march between the Yangong and Ralong Gompas, I was able to collect a whole series of fine fresh specimens of either *mus fulvescens* or *mus jerdoni*, which were lying dead and scattered along the track. The facts that, according to Babu R. B. Sanyal, the Superintendent of the Zoo in Alipur, a considerable mortality among house-rats is not by any means an unusual phenomenon in the early part of the cold weather in Calcutta, and the abrupt disappearance of the epidemics of field-voles which occasionally occur in this country and other parts of Europe, and which can only, apparently, be accounted for in like fashion, afford additional evidence that the mere occurrence of destructive epidemics among the rodents of a locality does not in itself afford any satisfactory evidence of the presence of plague or of conditions adapted to give rise to the disease there. The phenomenon was, however, sufficiently suspicious to demand special inquiry, and a careful examination was accordingly made of dead and dying rats obtained from the part of the town in which the epidemic prevailed. The results were not of a nature to encourage a belief that the animals were affected by plague. There were no evidences of any special glandular affection beyond the presence of a very large number of coccidia in the liver, and numerous cultivations of the blood and of materials derived from the lymphatic glands and other organs, although in many instances yielding growths of various kinds, failed to give any characteristic of the plague bacillus.

From the above data it is evident that, in so far as my experience went, there was no evidence of the existence of any disease presenting the bacteriological phenomena of plague in Calcutta in 1896.

April 19th, 1899. D. D. CUNNINGHAM.

APPENDIX No. LXXXVII.

(*See* Question No. 7269.)

ADDITIONAL NOTE TO DR. CLEMOW'S EVIDENCE.

THE following are the additional details of the second instance, given in my evidence, of a second attack of plague occurring in the same person:—

The patient was a Hindu, female, whose first attack of plague occurred in October 1897, when she was treated in the Arthur Road Hospital. With some difficulty I succeeded in tracing her case-sheet, and found that she was admitted to the hospital on October 15th, 1897. She is described as aged 10 (on her case-sheet in the Parel Hospital her age is given as 12). There was a bubo in the left groin, involving both the femoral and inguinal regions; the swelling was deep-seated, and there was much infiltration round it. On two occasions the temperature rose to 105°. There is no note in the case-sheet as to whether the bubo suppurated or was incised. The temperature curve was an irregular one, varying between 98° and 102°. She was transferred to the Parel Hospital on November 16th. Her case-sheet there contains no further details. She was discharged on December 13th.

The second attack occurred in April 1898. The details of this attack have already been given in my evidence. It is noteworthy that in each attack the bubo was in the left groin. The facts of the case, given in my evidence before the Plague Commission (*see* Question No. 7261) may be repeated here, for facility of reference, and are as follows:—

Case II.—Register No. 1060.—Hindu female, æt. 12, was admitted to the Parel Hospital on April 12th, 1898, with symptoms of plague. It was ascertained that she had had a previous attack of plague five and a half months earlier; she had been treated in the Arthur Road Hospital, Bombay, and had been transferred as a convalescent to Parel in December; her first discharge from the Parel Hospital was dated 13th December 1897. The second attack in April was a severe one; there was a left inguinal bubo, from which plague bacilli were isolated. She died on 14th April, 47 hours after admission, and 55 hours after the onset of symptoms.

F. G. CLEMOW.

APPENDIX No. LXXXVIII.

CORRESPONDENCE WITH W. M. HAFFKINE, ESQ., AND THE GOVERNMENT OF INDIA, REGARDING THE CORRECTNESS OF FIGURES CONCERNING INOCULATION IN THE BOMBAY JAILS, SUPPLIED TO THE INDIAN PLAGUE COMMISSION.

I.

On August 14th, 1899, Mr. Haffkine wrote to the President of the Indian Plague Commission, calling attention to correspondence published in the "Times," in which it was stated that "the impression left on the minds of many" was that Mr. Haffkine's statistics regarding prophylactic inoculation "are somewhat inaccurate." He continued: "In case, therefore, you, "or any member of the Commission, entertain any "doubt, or have any difficulty as to my reports on "inoculation, I should like, as I requested several "members of the Commission in India, that an "explanation be asked from me before your Report is "made public." Upon this, the following correspondence took place:—

II.

Letter from the Secretary to the Indian Plague Commission to W. M. Haffkine, Esq., C.I.E., dated India Office, 31.8.99.

SIR,

IN reply to your letter of the 14th August, 1899, to the President, I am directed to say that if you are anxious to make any further explanations regarding the statistics given in your own reports and evidence regarding inoculation, the Commission will be glad to receive them verbally from you on September 12.

2. I am at the same time to say that certain points of difference between your own evidence and reports and the evidence of other witnesses has attracted the attention of the Commissioners. The enclosed memoranda (A. and B.) of the official figures contain particulars of these differences, and the Commissioners will be glad to receive in writing anything you may desire to convey to them before September 7th.

3. The Commissioners will be glad to learn, when you reply to this letter, whether you wish to appear before them on September 12th or not. In case you do, I am to request that you will be present at the room occupied by the Commissioners in the India Office at 2.30 p.m.

MEMORANDUM A.

STATISTICS regarding PLAGUE in the BYCULLA HOUSE OF CORRECTION, BOMBAY, in JANUARY, 1897, comparing M. HAFFKINE'S FIGURES with OFFICIAL FIGURES.*

	Non-inoculated.				Inoculated.				Names and Official Numbers of Inoculated Prisoners who contracted Plague.
	Mr. Haffkine's figures.		Official figures.		Mr. Haffkine's figures.		Official figures.		
	Cases.	Fatal Cases.	Cases.	Fatal Cases.	Cases.	Fatal Cases.	Cases.	Fatal Cases.	
To January 30th, 1897, inclusive.	15	8	14	7	3	3	0	0	*a.* 672.—Kesbav Umishaukar *b.* 832.—Rama Lakshman. *c.* 1,222.—Govind Pandu. *d.* 1,356.—Abdul Karim Golam Hussain.' *e.* 1,336.—Ganput Babajee. *f.* 988.—Mahomed Hossein. *g.* 1,366.—Shamrao Sittaram.
Inoculations performed on January 30th, 1897.	Mr. Haffkine's figures show 183 prisoners not inoculated and 154 inoculated. The Official figures show 185 prisoners not inoculated and 153 inoculated.								
January 31st, 1897 -	2	1	2	1	1	0	0	0	
February 1st " - -	1	1	1	1	0	0	4 {*a.* *b.* *c.* *d.*	3 {*a.* *c.* *d.*	
" 2nd " -	1	1	1	1	0	0	1 *e.*	0	
" 3rd " - -	0	0	0	0	0	0	0	0	
" 4th " -	1	1	0	0	0	0	1 *f.*	1 *f.*	
" 5th " - -	2	1	2	1	0	0	0	0	
" 6th " -	5	1	4	1	1	0	0	0	
" 7th " - -	0	0	1	0	0	0	1 *g.*	0	
Total January 31st to February 7th -	12	6	11	5	2	0	7	4	

* *See* App. No. LX. in this volume.

MEMORANDUM B.

HER MAJESTY'S COMMON PRISON, UMARKHADI, BOMBAY.

The inoculations were done on the morning of January 1st, 1898.

According to Mr. Haffkine's figures, at the time of inoculation, the total population of the jail was 402, of whom 201 were inoculated; the official figures† show a population of 399, of whom 199 were inoculated.

According to Mr. Haffkine's figures, among those who were in jail on January 1, 1898, 10 of the non-inoculated got plague, of whom six died, while three of the inoculated got plague, none of the cases being fatal.

According to the official figures, it appears that 20 prisoners in all got plague. Of these four non-inoculated prisoners and one inoculated prisoner should be left out of consideration as they were not in jail on January 1, 1898, while three prisoners were attacked before the inoculations were done. Of the remaining 12 prisoners who got plague nine were not inoculated, and five of them died, while three were inoculated, among whom none died.

† *See* App. No. LIX. in this volume.

III.

From W. M. Haffkine. Esq., C.I.E., to The Secretary, Indian Plague Commission, Whitehall, London, dated London, 9th September 1899.

SIR,

I HAVE the honour to acknowledge with thanks the receipt of your letter, dated India Office, 31st August 1899, which reached me in Paris. I am glad that my letter to the President, of the 14th August, elicited the information, of which I was not aware, that there existed any discrepancy between mine and "the official" figures referring to the plague in the Byculla and Umarkhadi Jails in Bombay, though my being separated from my office records prevents me from substantiating my explanations as fully as I should desire.

The following is the analysis of the discrepancies pointed out in the appendices to your letter, so far as the materials at my disposal here permit me of analysing them.

BYCULLA HOUSE OF CORRECTION.

(*a.*) The number of attacks and deaths of plague to January 30th, 1897, inclusive, is uninoculated: my figures—15 and 8; "official figures"—14 and 7.

My figures represent the number of the following prisoners, whose names and particulars were supplied to me by the authorities of the House of Correction:—

Biva Bagu, prisoner, No. 977, admitted to hospital for plague on 25.1.97, died on 27.1.97.
Rama Gobin, prisoner, No. 1093, admitted to hospital for plague on 26.1.97, died on 30.1.97.
Ganu Baloo, prisoner, No. 1242, admitted to hospital for plague on 27.1.97, died on 31.1.97.
Ramgulab Rampratab, prisoner, No. 1094, admitted to hospital for plague on 27.1.97.
Narain Dondu, prisoner, No. 1359, admitted to hospital for plague on 27.1.97, died on 30.1.97.
Adamji Alibai, prisoner, No. 1349, admitted to hospital for plague on 27.1.97.
Katoo Lakmidas, prisoner, No. 1235, admitted to hospital for plague on 27.1.97.
Anton Salvador, prisoner, No. 1247, admitted to hospital for plague on 27.1.97.
Balkishna Madu, prisoner, No. 1272, admitted to hospital for plague on 27.1.97, died on 30.1.97.
Syed Junas Ali, prisoner, No. 1336, admitted to hospital for plague on 30.1.97.
Jiwa Virchand, prisoner, No. 1144, admitted to hospital for plague on 30.1.97.
Hussein Mahomed, prisoner, No. 1276, admitted to hospital for plague on 30.1.97.
Visram Jairam, prisoner, No. 1310, admitted to hospital for plague on 30.1.97, died on 5.2.97.
Valichand, prisoner, No. 1312, admitted to hospital for plague on 30.1.97, died on 3.2.97.
Ranji Jotie Pawa, prisoner, No. 1129, admitted to hospital for plague on 30.1.97, died on 1.2.97.

I am quite unable to explain, without an inquiry at the House of Correction, how, after having supplied me with the above details, which they knew were required by me for an official report to Government, the authorities could have given the above "official figures" of 14 and 7. The discrepancy should be the easier to clear up that it refers not to a mild or doubtful case, but to a case which *ended* fatally.

(*b.*) Same item, referring to inoculated: my figures 3 and 3; "official figures" 0 and 0.

My figures refer to the following three inoculated prisoners:—

Govinda Pandu, No. 1222.
Keishoo Umar Shunkar, No. 672.
Abdul Karim Gulam Hussein, No. 1356.

They were inoculated, together with the other 154 prisoners in the evening of the 30th January 1897. During the day of the 31st and part of 1st February, all had fever, but whereas in the others the fever disappeared or subsided towards the evening of the 1st, the above three had still high fever on the morning of the 2nd, and were taken to the hospital, where they were found suffering from painful glands. They were at once admitted as plague cases, and entered as such in the Jail Hospital book, under the date of admission. But Mr. King, Assistant Surgeon, on duty at the House of Correction, and myself, went to take notes of the symptoms of the patients, and found that:

Govinda Pandu, who had been inoculated in the left flank on the 30th January, had a painful bubo in the left axilla, which he felt since the evening of the 30th January, but *subsequent* to inoculation.

Keishoo Umar Shunkar, who had been inoculated in the right flank, had a painful bubo in the left groin, which he felt since the day of inoculation, *previous* to being inoculated; and

Abdul Karim Gulam Hussein, who had been inoculated also in the right flank, had a painful bubo in the left armpit, which he felt since the evening of the 30th January, *subsequent* to inoculation.

The details, of which I took at the time very careful notes, as they had a very great importance with regard to the question as to the time which the inoculation would take to exercise a protective effect, will certainly be found reproduced also in Mr. King's clinical notes which he kept at the time of the outbreak. The Jail Hospital tabulated registers have, I believe, a column for the date of admission of patient to the hospital; and the patients, in the Byculla House of Correction, during the outbreak of 1897, were admitted to the Plague Hospital shed only after the fact of their suffering from plague became clear, which, in some instances, was a day or two after the appearance of initial symptoms. During this undecided period the patients were kept in an observation ward; *but* with regard to the above-mentioned question, viz., the length of time which the inoculation required for preventing the occurrence of an attack in an inoculated individual, the date of the appearance of those initial symptoms, and not of the admission of the patient to the Plague Hospital, was of importance, and that is why I stated that Govinda Pandu, Keishoo Umar Shunkar, and Abdul Karim Gulam Hussein were attacked on the 30th January 1897, when their glands, which subsequently developed into actual plague buboes, first appeared, and not on the day when they were admitted to the plague shed.

(*c.*) Strength of jail population on 30th January 1897: my figures, 183 uninoculated and 154 inoculated; "official figures," 185 uninoculated and 153 inoculated.

Unfortunately I have not with me here the nominal list of the inoculated in the House of Correction of 30th January 1897; but I have with me a table which I made out on the 8th February 1897, together with Mr. Hall, the Superintendent of the Jail, in his office, from the jail books, and which shows that, excluding the prisoners already taken to the Plague Hospital, the numbers of inoculated and uninoculated were:—

In the evening of the 30th January 1897, when the inoculations where done, 154 and 183; on the mornings of—

January 31, 1897, 151 and 177;
February 1, 1897, 150 and 172;
February 2, 1897, 146 and 173;
February 3, 1897, 176 and 172;
February 4, 1897, 146 and 171;
February 5, 1897, 146 and 169;
February 6, 1897, 146 and 169;
February 7, 1897, 146 and 165; and of
February 8, 1897, 146 and 161.

(*d.*) January 31st, 1897, cases and deaths in inoculated: my figures, 1 and 0; "official figures," 0 and 0.

My figures refer to the prisoner Rama Luxman, No. 832, inoculated on 30th January 1897 in right flank, who was admitted to the plague shed on 1st February 1897, but had a painful bubo in the right axilla since the previous day. On account of the reasons above mentioned under paragraph (*b*) he is entered in the Jail Hospital register under the date of the 1st February 1897, and in the laboratory books under the date of January 31st. These details will, undoubtedly, be found also in Mr. King's clinical notes, as all my rounds in the jail were made in the company of the jail authorities, and my information obtained through their own inquiry made in my presence.

(*e.*) February 1st, cases and deaths in inoculated: my figures, 0 and 0; "official figures," 4 and 3.

The explanation of the discrepancy is given in the above paragraphs (*c.*) and (*d.*).

(*f.*) February 2nd, cases and deaths in inoculated: my figures, 0 and 0; "official figures," 1 and 0.

The official figures refer to prisoner Ganpat Babajee, No. 1336, inoculated on 30th January 1897, in the evening.

He was discovered at 5 p.m. of the 2nd February, with a temperature of 102° Fahr., and was admitted to the plague shed; but next morning was free from fever. During the day of the 3rd February he complained, however, of pain in the lower jaw, but no swellings

could be found there; and the pain disappeared during the day of the 4th.

In informing me about this case, the authorities of the jail stated that Gunpat Babajee suffered from 12 hours of fever, that certainly it could not have been a case of plague, but that he had been entered into the books as admitted into the plague shed, and that it was impossible to make any corrections there.

(*g.*) February 4th, cases and deaths uninoculated: my figures, 1 and 1; "official figures," 0 and 0.

My figures refer to prisoner Mahomed Hussein, No. 988, who undoubtedly, by an error, is placed in the "official figures" for the same date among the inoculated.

Unfortunately, as mentioned above, I am unable to find among the notes I have with me here, a nominal list of the prisoners who were inoculated in the Byculla Jail on the 30th January 1897. Such a list does exist in the Laboratory Office in Bombay, and the fact of inoculation must also have been entered in the jail ticket of the inoculated prisoners. But I cannot conceive any possibility of a mistake on my part on the point in question. I have with me here a copy of my report, dated 15th February 1897, to the Secretary to the Government of India in the Home Department. In the list of plague occurrences in the jail it is stated, referring to the 7th of February:—"On the 5th day "after inoculation there were, amongst 171 non-inocu- "lated, 1 case which proved fatal: amongst 146 inocu- "lated, nil." When sending the above report to the Home Secretary, I sent a copy of it also to Mr. C. P. H. Snow, I.C.S., Municipal Commissioner of Bombay, who asked also for a report from Lieut.-Colonel Waters, I.M.S., the medical officer of the jail. The report of the latter was communicated by the Municipal Commissioner to the Bombay papers, and was reproduced by them, and I remember distinctly that it was identical with mine.

In the experimental note book which I have with me here, on page 696, the following details are given under date 5.11.97.

"(3.) Mahomed Hussein (not inoculated). Fever since yesterday, 4.11.97. Now unconscious, cannot answer questions."

"6.11.97. Still unconscious. No glands."

"7.11.97. Since yesterday evening painful and swollen gland in right femoral region."

"8.11.97. Mahomed Hussein died at 3.30 p.m."

On page 702 of the same note book, in a table made by Mr. Hall, Superintendent of the Jail, Mr. King and myself, in the office of the jail, under the date of 4.11.97, the space for inoculated shows a blank, that for the uninoculated shows one case fatal.

In another table referring to the attacks of plague in vaccinated against small-pox, and which I made out on the 8th February 1897, also with the assistance of the authorities of the jail, Mahomed Hussein, re-vaccinated on 4th March 1897, is shown also among the uninoculated, and at no moment, although the details of the outbreak were for many weeks examined and re-examined time after time, has it been mentioned that a fatal case of plague among the inoculated occurred after the first three fatal cases (those of the 30th January). It should be no difficulty whatever to find out from the jail authorities how it occurred now that the prisoner in question has been stated to be an inoculated.

(*h.*) Byculla House of Correction, 4th February; cases and deaths in inoculated: my figures, 0 and 0; "official figures," 1 and 1.

Vide above, paragraph (*g*).

(*i.*) February 6th, cases and deaths in uninoculated: my figures, 5 and 1; "official figures," 4 and 1.

My figures include prisoner Mummo Ibrahim, No. 993, who, although admitted to the plague shed on 7th February and shown in the "official figures" under that date, had fever already since the 6th.

(*j.*) Same date, cases and deaths in inoculated: my figures, 1 and 0; "official figures," 0 and 0.

My figures refer to prisoner Shamram Sittoram, No. 1,366, who, although admitted to the plague shed on 7th February, and shown in the "official figures" under that date, had fever already since the 6th.

(*k.*) The difference under the date of February 7th, is explained in the above paragraphs (*i.*) and (*j.*).

Summary of the Details referring to the Byculla Jail.

It will be seen from the above that the important differences between mine and the "official figures" consist in—

(1) Prisoner Mahomed Hussein being referred to in the "official figures" as an inoculated, which seems to me to be undoubtedly a mistake, and which can be verified by reference to the list of inoculated; and

(2) In the date under which prisoners Govinda Pandu, Keishoo Umar Shunkar, and Abdul Karim Gulam Hussein are referred to, and which in my table represents the date of the outset of the disease, while the "official figures" refer to the date of their admission to the plague shed and of entry in the Plague Hospital register.

The Umarkhadi Common Jail, Bombay.

(*a.*) Paragraph 1 of your Appendix: only 199 prisoners were inoculated, as the "official figures" rightly show. I do not remember having stated that 201 were inoculated. If I did, my mistake was probably due to the fact that the number of persons inoculated in the Umarkhadi jail on the 1st January 1898 was, indeed, 201, but two of them were Major Collie, I.M.S., the medical officer of the jail, and Mr. N. M. Wadiagaonkar; the latter, I believe, is the Assistant Surgeon on duty in the jail. But I believe it to be likely that I have not stated that 201 prisoners were inoculated; that that number was concluded, by the author of your appendix, from my stating that the total number of prisoners brought to the courtyard on the 1st January 1898 was 402, and that every second man or woman were inoculated. The author, taking the half of 402 as having been inoculated, did not consider that I have added that two of the prisoners who happened to be second in a pair, did not choose to be inoculated, which brought the number of 201 down to 199, and that of uninoculated to 203. In any case, it is certain, from the nominal list of the inoculated on that occasion, which I have here with me, that the number 199 is the correct one.

On the other hand, the number of uninoculated was by three higher than that mentioned in the "official figures" (203 instead of 200), and the total was 402, as I have stated. This is apparent from the nominal list, with all the particulars of the uninoculated prisoners present in the jail on the 1st January 1898, which list I have also with me here. The list shows in all 216 names, of whom six, viz.,—

Mahadu Kondaji	- -	Prisoner No. 7
Kassamkhan Amer Mahomed		,, No. 127
Kissan Hari	- -	,, No. 214
Hari Bahaji	- -	,, No. 257
Lenna Penna	- -	,, No. 306 and
Jiwee, wife of Peera	-	,, No. 42

were released the same morning while we were doing inoculation, five were on the sick list, suffering from various diseases, and kept under conditions different from those of the bulk of the prisoners, viz.:—

Kasmat Waman Lele, prisoner No. 205, suffering from curvature of spine since 26.11.97;

Kameedali Taigali, No. 183, down with an abscess since 17.11.97;

Lakmanji Mathabhai, No. 225, down with an abscess since 3.12.97;

Mahomed Walikhan, No. 83, suffering from chronic diarrhœa since 12.10.97; and

Koudia Siwa, No. 120, suffering from ague since 3.12.97;

and lastly, two were isolated in the plague ward, viz.:—

Moolabux Rahimbux, No. 151, attacked with plague on 31.12.97.; and

Arjuna Raji, No. 215, attacked on same date.

This leaves 203 uninoculated, who lived under the same conditions and remained exposed to the same chance of infection as the 199 inoculated.

(*b*) Paragraph 2 of your appendix, referring to the Umarkhadi Jail. In the list of 216 uninoculated prisoners who were present in the jail on the day of inoculation (including the plague patients who were still alive), the following 12 are shown to have been attacked with plague:—

Molabux Rahimbux, No. 151, attacked on 2 .2.97, died on 1.1.98.

Arjuna Raju, No. 215, attacked 31.12.97, died 6.1.98.
Booda Hanma, No. 13, attacked 1.1.98, died 4.1.98.
Andrew Menuse, No. 278, attacked 2.1.98, recovered.
Ramjan Elahibux, No. 186, attacked 17.1.98, died 22.1.98.
Sadu Rama, No. 147, attacked 18.1.98, recovered.
Sheik Hussein Sheik Baban, No. 33, attacked 18.1.98, died 20.1.98.
Govind Rama, No. 65, attacked 20.1.98, recovered.
Bhori Sakaram, No. 163, attacked 20.1.98, recovered.
Karimkhan Azamkhan, No. 283, attacked 24.1.98, died 27.1.98.
Maruti Babaja, No. 35, attacked 24.1.98, died 26.1.98.
Girder Motiram, No. 104, attacked 30.1.98, died 3.11.98.

But there must have been a 13th fatal case of plague in the jail, not mentioned, among the 216 prisoners, as he was already dead on the 1st January 1898, when the inoculations were done. This results from the following: the above list of 12 patients begins with two cases of plague which occurred on the day before the inoculation, viz., on the 31st December 1897, and which were still alive at the time of inoculation. These were:—

Molabux Rahimbux, No. 151, attacked on 31.1.97, died on 1.1.98, and
Arjuna Raju, No. 215, attacked 31.12.97, died on 6.1.98.

On the 31st of December of 1897 I was in Poona, organizing with Lieut.-Colonel McConaghy, I.M.S., then Civil Surgeon there, two inoculation stations; and there must have occurred in the Umarkhadi Jail a fatal case a few days before the 31st December, as before leaving for Poona I had arranged with Dr. Leon, on plague duty in the Umarkhadi District of Bombay, that should another case occur in the jail he should wire the information to me to Poona, and I would come down to Bombay to inoculate the prisoners personally. It was on the occurrence of those two subsequent cases of the 31st of December that I received the wire from him, upon which I indeed returned to Bombay and inoculated the prisoners on the New Year's Day. Dr. Leon is in London, serving in the Paddington Infirmary, at Harrow Road, and I wired to him on the 6th instant asking for his notes on the plague cases at Umarkhadi; but, as will be seen from the attached reply, they could not be got immediately. I shall forward further details to the Commission if I get them.

The inoculations were done very early, about 6 or 7 a.m., on the 1st of January 1898, and it was because of this circumstance that I did not exclude from the list the case of Booda Hanma, No. 13, attacked in the course of that day. The "official figures," mentioning only the attacks in those who were still alive and present in the jail on the 1st January 1898, omit the case of the prisoner who died a few days before (including him possibly among the four non-inoculated prisoners attacked who were not in jail on 1st January 1898); on the other hand, I presume, they thought it safer to reckon the case which occurred on the 1st of January among those that took place before inoculation, although, as it appears from the numbers of 199 inoculated and 203 uninoculated, Booda Hanma must have been in the courtyard, in the ranks of prisoners paraded before us, while the inoculation was done.

The above completes the analysis of the discrepancies. I can only regret that those discrepancies did not come before us while in Bombay. It will be seen from the above explanations that they are of a nature easily to be substantiated by reference to the official books and by a few explanations from the officials as to details not recorded in the tabulated official books.

In case the Commission finds it desirable to have any further data as to the observations in the jails, or any others on which the evidence given by me bears, I shall hold myself in readiness to meet them, if invited, on the 12th instant.

I take this opportunity only of drawing their attention to a circumstance which may possibly render less paradoxical the table of mortality in Karachi among the inoculated and uninoculated Khoja children with regard to which I was questioned by the Commission in Bombay.

I did not know at the time that Dr. Kaka, the Health Officer of Karachi, who carried out the inoculations there, had not inoculated children in arms and under one year of age, on the ground that they do not take plague (which is, indeed, to a very great extent, the case). On referring to the vital statistics it will be seen that the normal mortality among children in India falls chiefly among those under one year; I believe it is often four, five, even six times higher than the mortality among children above one and up to five years; and when compared with the total mortality in a community that of children below one is by far the largest item. By leaving children below 1 in the group of the uninoculated, Dr. Kaka freed the inoculated from that largest item of the normal mortality. Considering further that the observations refer to a time subsequent to a very severe epidemic, which must have killed off a number of sickly individuals in the groups above one year; the absence of deaths amongst the inoculated from general causes during the six months under observation seems to me more comprehensible.

In giving the above considerations, I, of course, do not mean to take upon myself the responsibility for the Karachi observations, as I have never been in Karachi and am unacquainted with the conditions under which the observations were made. At the same time, in the inquiries made in Bombay, I could not detect the least reason for doubting the perfect good faith and veracity not only of the officers who carried out the observations but of the inoculated community itself amongst whom the observations were carried out.

Enclosure in No. III.

Paddington Infirmary,
Harrow Road, W.,
September 7th, 1899.

DEAR HAFFKINE,

I WENT to Portland Place to-day and looked for the notes of the plague cases, but I am sorry to say I could not find them. Our house is in the hands of the builders and everything is stowed away all over the place, so it is quite possible that they will turn up later on, when I will let you have them. Kind regards from,

Yours sincerely,
JOHN P. LEON.

IV.

On the 12th September 1899, the Com[illegible] formed Mr. Haffkine that they did [illegible] mission in request him to appear to put any ora[illegible]t propose to them, but that they were making i[illegible]tatement before from the Government of Bo[illegible]tiries by telegram Mahomed Hussein, Prisoner [illegible]ay as to whether Jail, Bombay, was or was [illegible]. 988, in the Byculla 1897. The Commissioners [illegible] inoculated in January ascertain by telegram [illegible] also desired Mr. Haffkine to appears in the record [illegible] whether Mahomed Hussein or not. A telegr[illegible]n in his laboratory as inoculated mission to th[illegible] was accordingly sent by the Com- Government [illegible]overnment of Bombay through the to his labo[illegible]ndia, and Mr. Haffkine also telegraphed informa[illegible]ry in Bombay asking that the required India [illegible] might be sent by telegram through the [illegible]ce.

V.

The following telegram was received from the Government of India through the India Office on the the 20th September, 1899:—

"Your telegram, 12th September, Prisoner 988, Mahomed Hussein, Byculla Jail, was not inoculated."

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